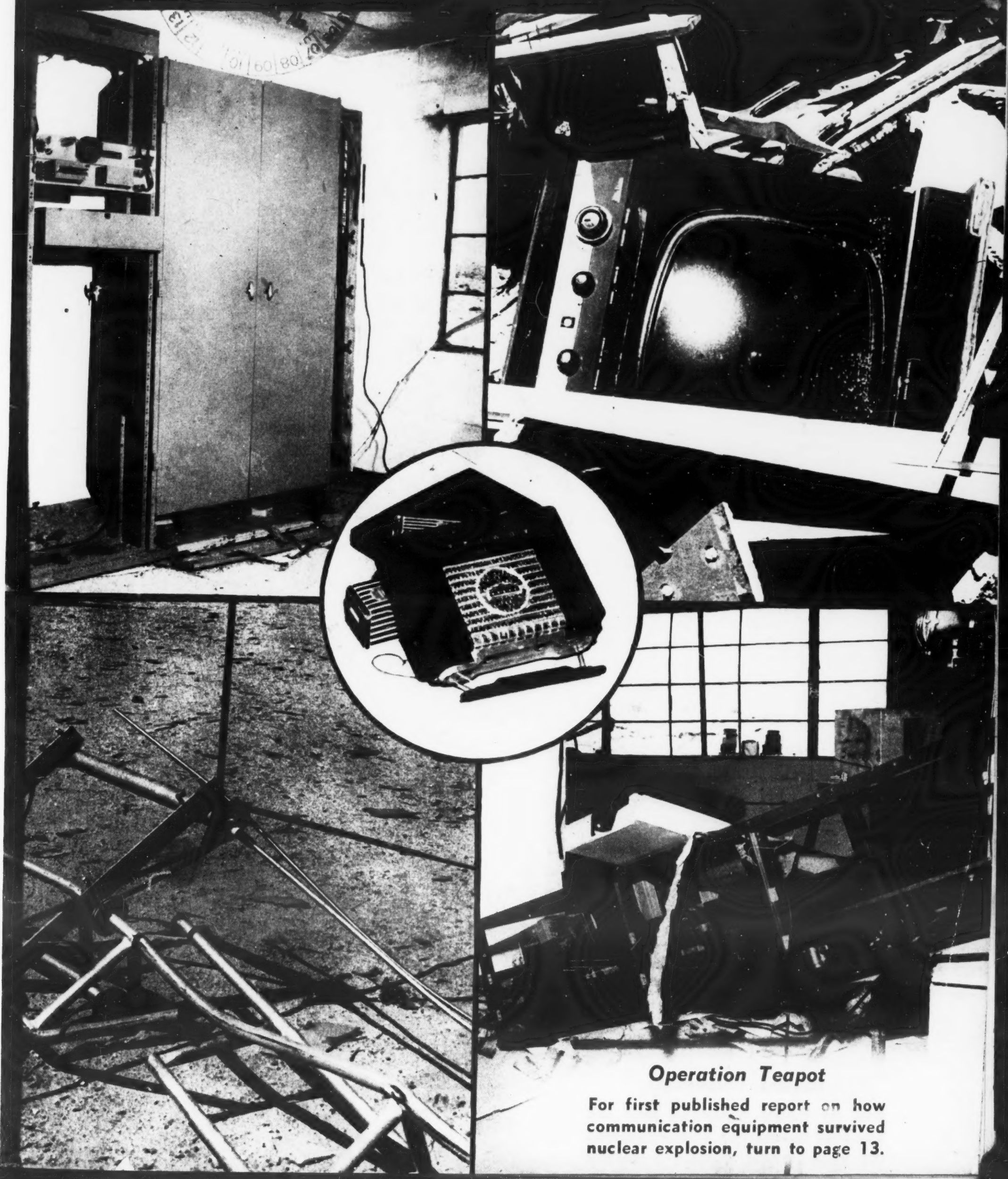

Operation Teapot

For first published report on how communication equipment survived nuclear explosion, turn to page 13.

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MQ Series
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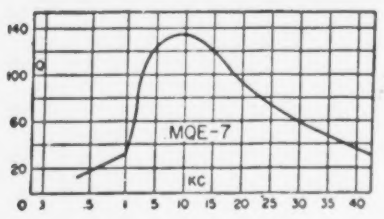
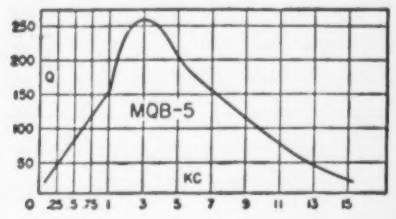
The MQ permalloy dust toroids combine the highest Q in their class with minimum size. Stability is excellent under varying voltage, temperature, frequency and vibration conditions. High permeability case plus uniform winding affords shielding of approximately 80 db.

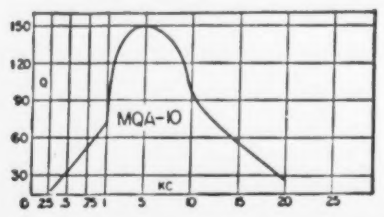


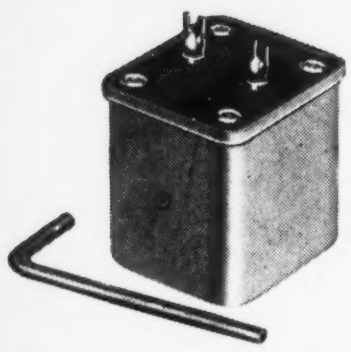
MQE
15 stock values
from 7 Mhy.
to 2.8 Hy.



MQB
12 stock values
from 10 Mhy.
to 25 Hy.

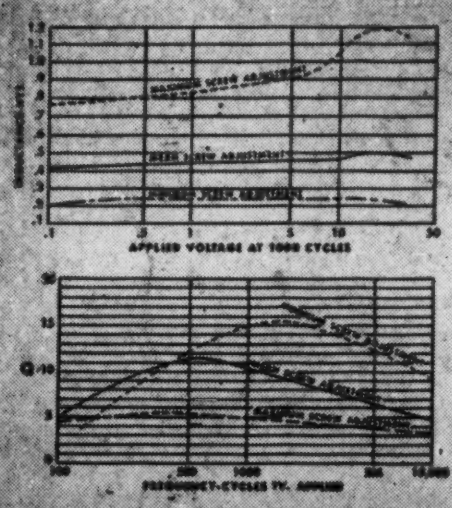
MQA
19 stock values
from 7 Mhy.
to 22 Hy.





VIC case structure

Length	Width	Height
1-1/4	1-11/32	1-7/16



Type	Mean Hys.	Type	Mean Hys.
VIC-1	.0085	VIC-12	1.3
VIC-2	.013	VIC-13	2.2
VIC-3	.021	VIC-14	3.4
VIC-4	.034	VIC-15	5.4
VIC-5	.053	VIC-16	8.5
VIC-6	.084	VIC-17	13.
VIC-7	.13	VIC-18	21.
VIC-8	.21	VIC-19	33.
VIC-9	.34	VIC-20	52.
VIC-10	.54	VIC-21	83.
VIC-11	.85	VIC-22	130.

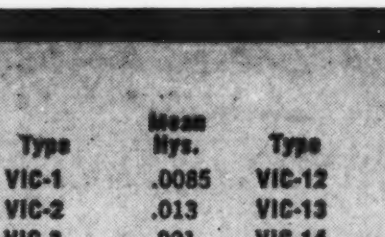
VIC Variable Inductor

The VIC Inductors have repr sented an ideal solution to t problem of tuned audio circuit A set screw in the side of t case permits adjustment of t inductance from +85% to —45 of the mean value. Setting positive.

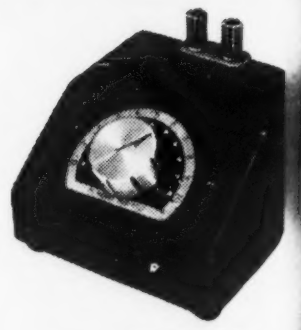
Curves shown indicate effect Q and L with varying freque and applied AC voltage.

DI Inductance Decades

These decades set new standards of Q, stability, frequency range and convenience. Inductance values laboratory adjusted to better than 1%. Units housed in a compact die cast case with sloping panel ideal for laboratory use.



DI-1	Ten 10 Mhy. steps.
DI-2	Ten 100 Mhy. steps.
DI-3	Ten 1 Hy. steps.
DI-4	Ten 10 Hy. steps.

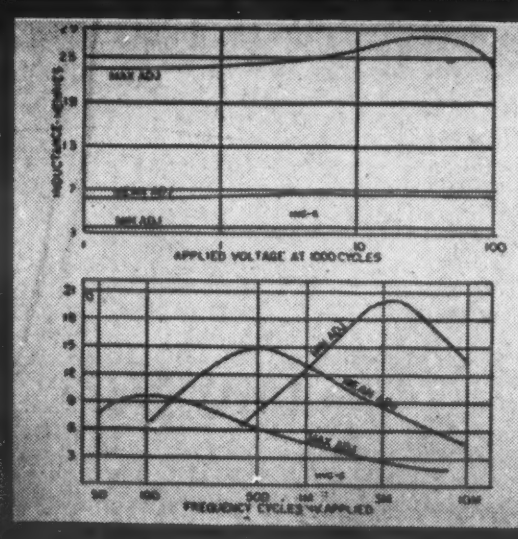


DI DECADE

Length	4
Width	4
Height	2

HVC Hermetic Variable Inductors

A step forward from our long established VIC series. Hermetically sealed to MIL-T-27 . . . extremely compact . . . wider inductance range . . . higher Q . . . lower and higher frequencies. . . superior voltage and temperature stability.



Type No.	Min. Hys.	Mean Hys.	Max. Hys.
HVC-1	.002	.006	.02
HVC-2	.005	.015	.05
HVC-3	.011	.040	.11
HVC-4	.03	.1	.3
HVC-5	.07	.25	.7
HVC-6	.2	.6	2
HVC-7	.5	1.5	5
HVC-8	1.1	4.0	11
HVC-9	3.0	10	30
HVC-10	7.0	25	70
HVC-11	20	60	200
HVC-12	50	150	500

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THREE TELEPHONE PIONEERS from different sections of the country are shown here. They are Robert C. Price of Williamsport, Pennsylvania; Mrs. Marguerite T. Burns of Minneapolis, Minnesota; and Melvin F. Held of St. Louis, Missouri. Shown also are the emblems of the two Pioneer associations.

They're Telephone Pioneers

Experience and fellowship of long-term telephone men and women are important factors in good telephone service

Robert C. Price, Mrs. Marguerite T. Burns, and Melvin F. Held, shown together here, are Telephone Pioneers.

They are representative of the more than 180,000 men and women who belong to two big and important organizations in the telephone business.

These are the Telephone Pioneers of America and the Independent Telephone Pioneer Association.

These two organizations are composed of employees who have spent many years in the business, their average service being well over 21 years. About one out of every four telephone people in the Bell System and independent telephone companies in the United States and Canada is a Pioneer.

Each day the active, working Telephone Pioneers bring over 3¾ million years of "know-how" and experience to the job. Equally important is their spirit of service that is so important a part of the telephone business.

By sustaining and nourishing this spirit, they help to insure its continuance and provide a solid foundation for greater progress to come.

The fast, courteous, low-cost telephone service you enjoy today is due in no small measure to the men and women who wear the proud emblems of the Telephone Pioneers.

BELL TELEPHONE SYSTEM

SIGNAL

Communications-Electronics-Photography

Journal of the Armed Forces Communications and Electronics Association

VOLUME 10 SEPTEMBER-OCTOBER 1955 NUMBER 1

1624 Eye Street, NW
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SIGNAL is published bi-monthly by the Armed Forces Communications and Electronics Association at 1624 Eye St., N. W., Washington 6, D. C. Entered as Second-class matter at Post Office, Washington, D. C., September 6, 1946, under Act of March 3, 1879, Additional entry at Baltimore, Maryland.

Subscription rates: 1 year (6 issues), $6.00. To foreign post offices, $6.50.

Printed in U.S.A. by Monumental Printing Co. at Baltimore, Md. The publisher assumes no responsibility for return of unsolicited manuscripts or art. When sending change of address, please list the old and new addresses, and allow 3 weeks for delivery of first copy.

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Views of some commercial communication equipment after Operation Teapot. Turn to page 17 for "before" pictures.

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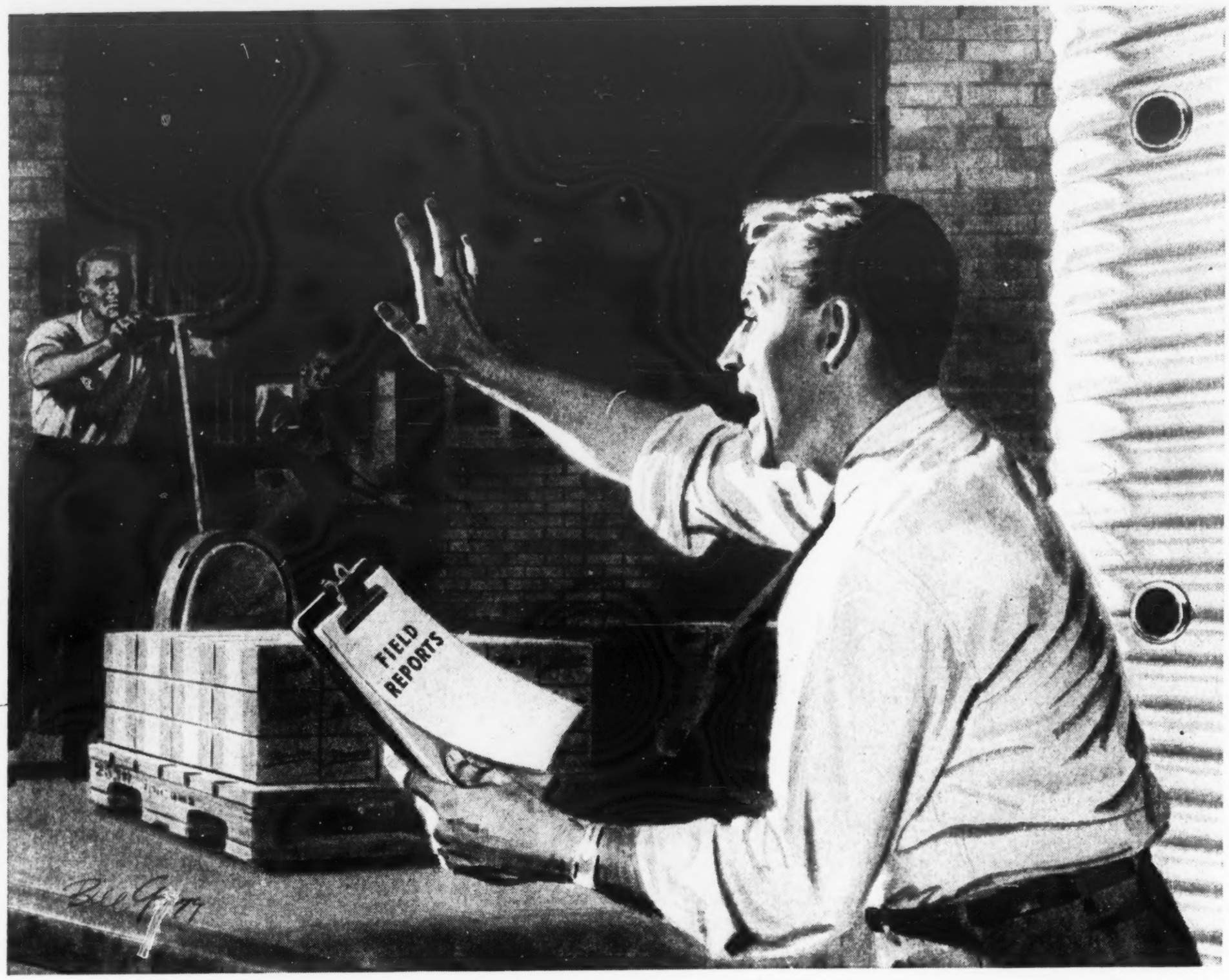
Departments

Authors are entirely responsible for opinions expressed in articles appearing in AFCEA publications, and these opinions are not to be construed as official or reflecting the views of the Armed Forces Communications and Electronics Association.



The day Zenith refused to fill thousands of orders

Back in early 1953, Zenith was about to market a new and revolutionary hearing aid which featured transistors instead of bulky vacuum tubes. These tiny transistors—the "powerhouses" of electronics—slashed battery operating costs, required only one battery instead of two, and promised a much longer life.

We ordered our transistors from a large electronics supplier and installed them in a pilot run of our tiny new hearing aids. Then, in line with our policy of *double testing* every Zenith product, both civilian and military, we sent the aids to our laboratory—"Phase One" in our testing procedure. They passed with flying colors.

Then, even though competitive models were now being offered for sale, we submitted our new hearing aids for *field and life* testing, "Phase Two" of the rigorous test series through which all new Zenith models must pass.

This field and life testing was done by a selected group of hard-of-hearing physicians, scientists and other qualified hearing aid users who tested the new product in everyday use, under every possible condition! Their reaction was so enthusiastic that we tooled up, built an inventory, and planned to hit the market on April 6, 1953.

Then it happened. The transistors in the new hearing aids began to *fail* due to a complication that could *only* be discovered by prolonged actual use!

This, at a moment when production lines were running at full speed . . . when a gigantic advertising program was ready to be launched . . . when dealers were shouting for shipments . . . when consumers by the thousands were begging for new hearing aids!

In the face of all this, we called the whole thing off.

We refused to fill thousands of orders that had already poured in. We refused to give our customers a hearing aid that might fail when it was needed most. We urged people to continue buying the reliable vacuum tube model until transistors were perfected.

And perfected they finally were. After again assembling the new transistor hearing aids . . . after again testing them in the laboratory and in the field, Zenith finally offered them to the public in November, 1953. At long last, here was a transistor hearing aid which would *not* fail those who depended upon it . . . a new, *quality* hearing aid which had finally earned the right to bear the Zenith insignia.

•

This story is just one more example of Zenith's insistence upon testing, re-testing, and absolute perfection. It is one reason why Zenith is called upon so frequently by the Government to turn out always-dependable weapons of defense. Our 36 years of specialization in radionics has created a Pledge of Quality which remains inviolate: *always the best of everything . . . in everything that Zenith makes.*

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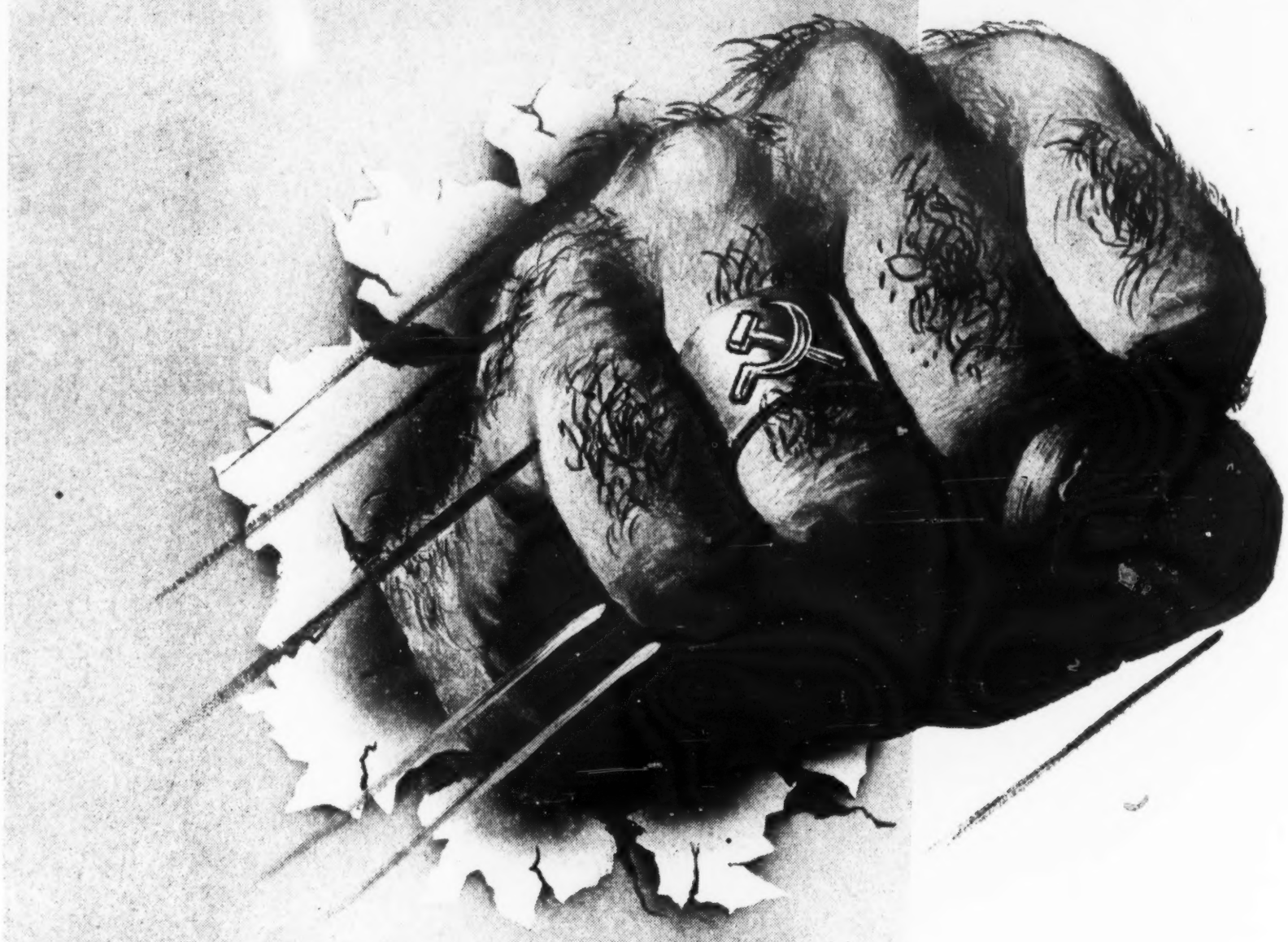
"We shall smash them with our clenched fist"



"War to the hilt between communism and capitalism is inevitable. Today, of course, we are not strong enough to attack. Our time will come in 20 or 30 years. To win we shall need the element of surprise. The bourgeoisie will have to be put to sleep. So we shall begin by launching the most spectacular peace movement on record. There will be electrifying overtures and unheard of concessions. The capitalist countries, stupid and decadent, will rejoice to cooperate in their own destruction. They will leap at another chance to be friends. As soon as their guard is down, we shall smash them with our clenched fist."

Dimitry Z. Manuilsky

Presiding Officer U. N. Security Council, 1949
From a Speech before the Lenin School of Political Warfare, 1931

Communism is the implacable enemy of our country! Dedicated to our annihilation, it moves stealthily, employing all the wiles of a cunning animal. Today it soothes us with talk of peace. Tomorrow it rattles the saber. Always, it moves toward a calculated goal that has been spelled out for all of us to read. Every American must awaken to these realities if our nation is to survive.

W B Stuart

President

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Next time you see one of our "Regency" model television receivers in someone's home, or in a store, take a good look at the door pulls.

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Performance-wise, Stromberg-Carlson TV receivers are the finest. But we see no reason why beauty must be sacrificed to utility. In our designers' minds, the receivers we market must add to a home's good looks, as well as its entertainment.

Battersea porcelain door pulls form only one example. Hand-decorated Chinese panels (no two ever quite alike)—tambour doors—tops of burn-proof, liquid-proof "Marlite"—lowboy models designed expressly for the ranch-type home—such decorator touches impressed the Academy of Color and Design to the point of granting us their 1954 Award—only one of many commendations received over the years for excellence in styling.

"Genius," said one authority, "means only an infinite capacity for taking pains." We'll never be brash enough to claim the first part of that quotation—but we've subscribed to the latter now for more than sixty-one years.

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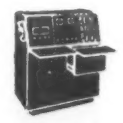

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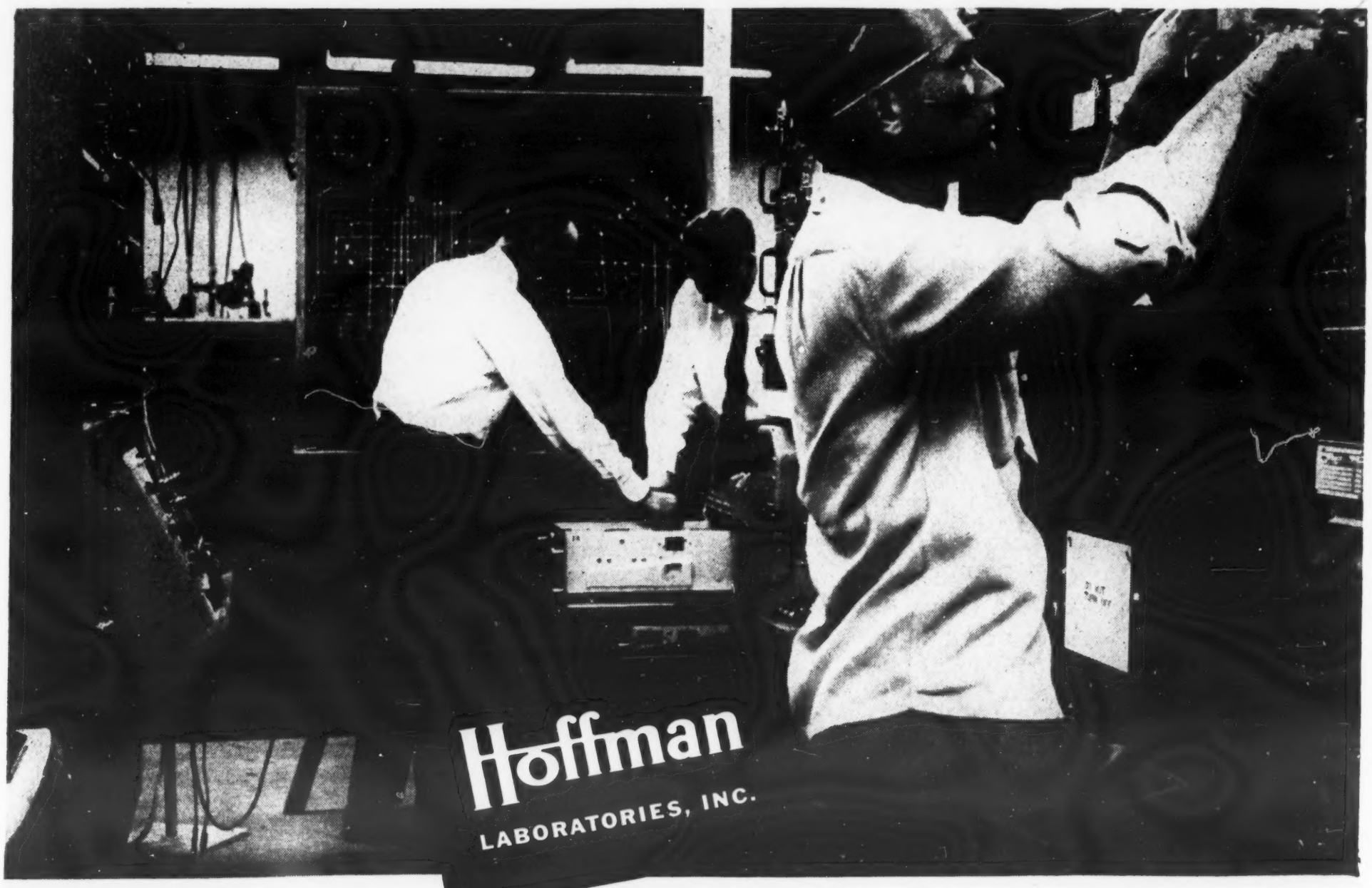

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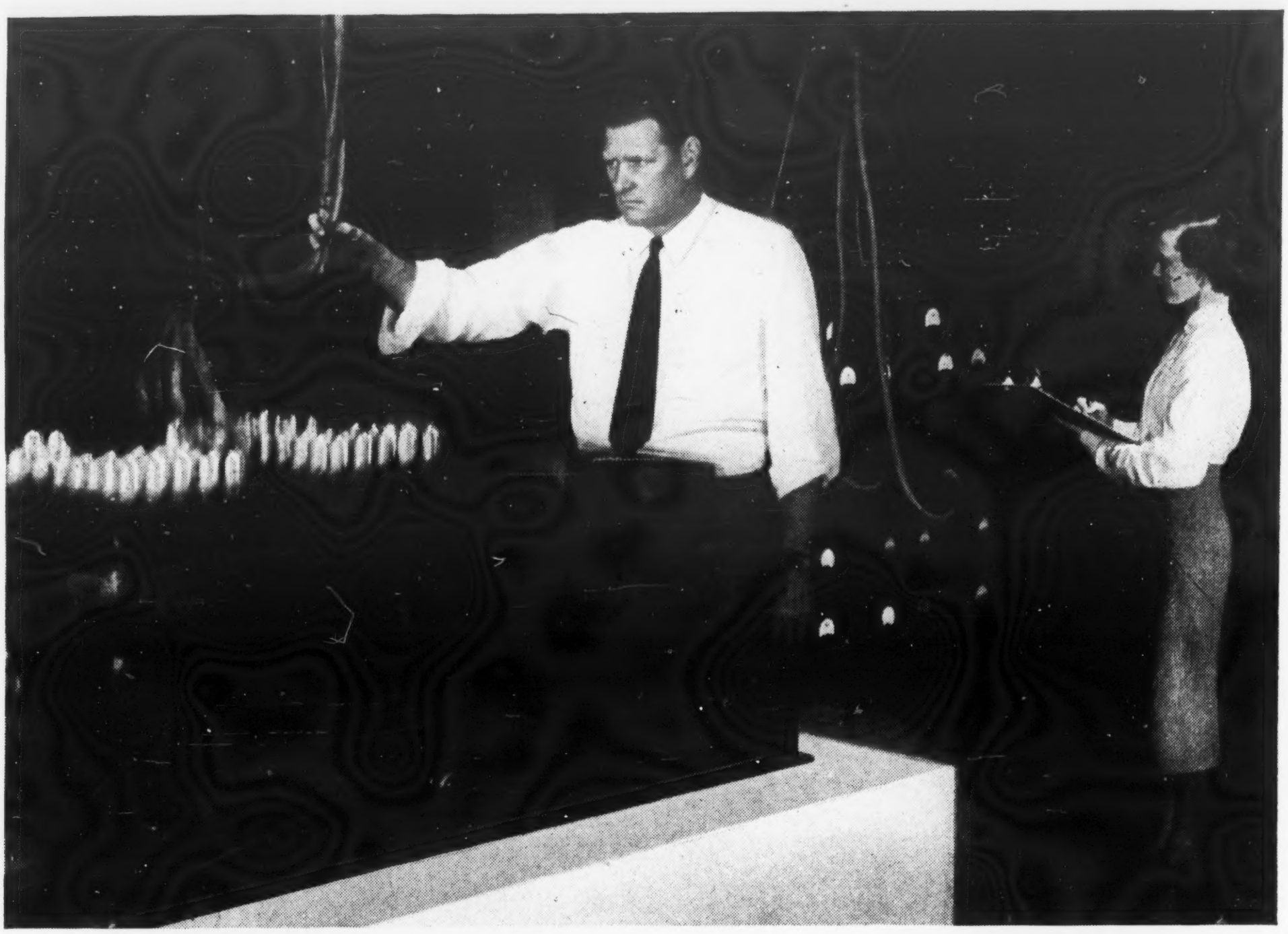

G-E high-reliability tube test equals 40 mph truck ride over a rough road!

WHAT you see is an exact parallel of the shock and vibration conditions described. In cooperation with the U. S. Army Signal Corps, G. E. is carrying on an extensive test and analysis program for high-reliability tubes at its Owensboro, Ky., tube factory. As part of the program, tubes are shaken and pounded at blurring speed while they are mounted on the unsprung weight of a heavy steel slab with concrete base.

All the time, the tubes are in full electrical operation. Instrumentation tells a running story of performance. This tough, realistic test helps assure that electronic tubes have top reliability when installed in critical communications, gun-control, radar, or military sockets of other types.

High-reliability tubes manufactured by General Electric carry the name "5-Star". Their design is special throughout, accenting strength along with dependability and long life. They are built to highest precision standards, and production is located in a building apart from the rest of the G-E tube plant—air-conditioned, immaculately clean, with workers and inspectors a selected group who are trained to put quality first.

Ask for G-E 5-Star high-reliability types in new equipment! Always install them as tube replacements! *Tube Department, General Electric Company, Schenectady 5, New York.*

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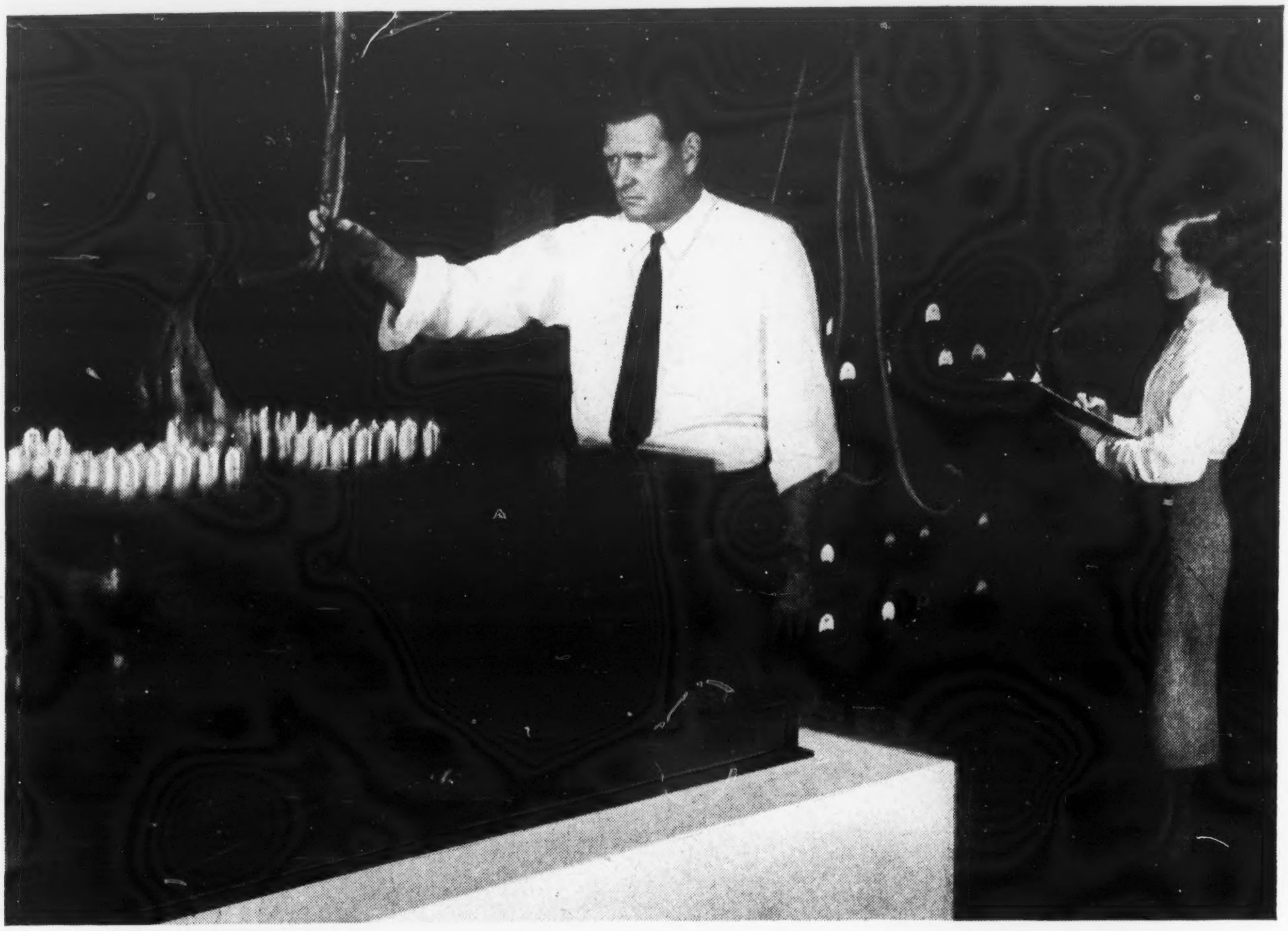

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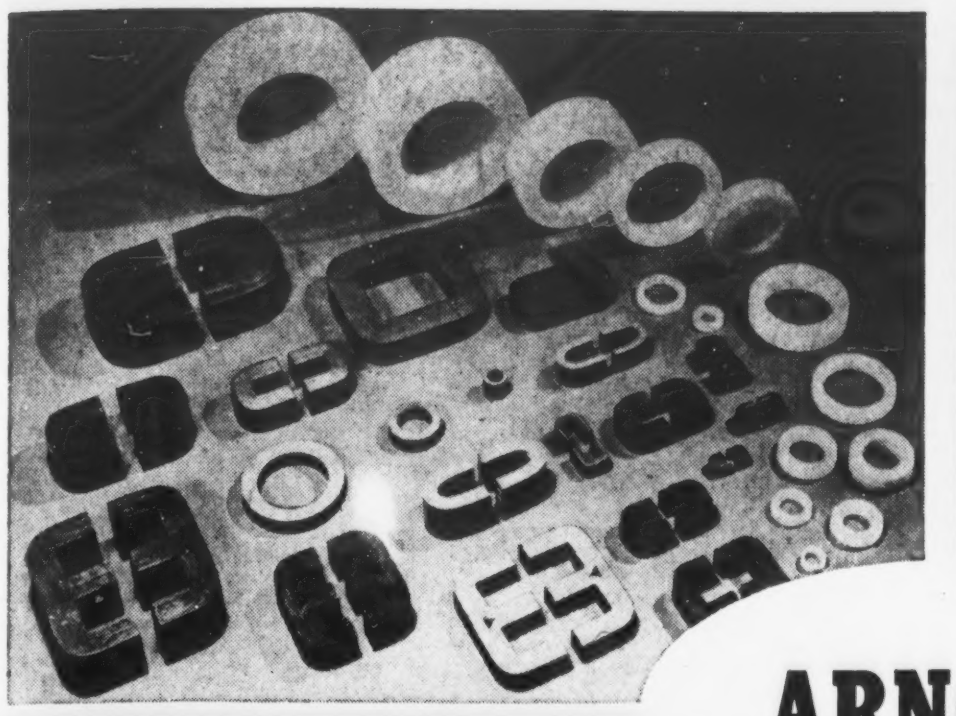

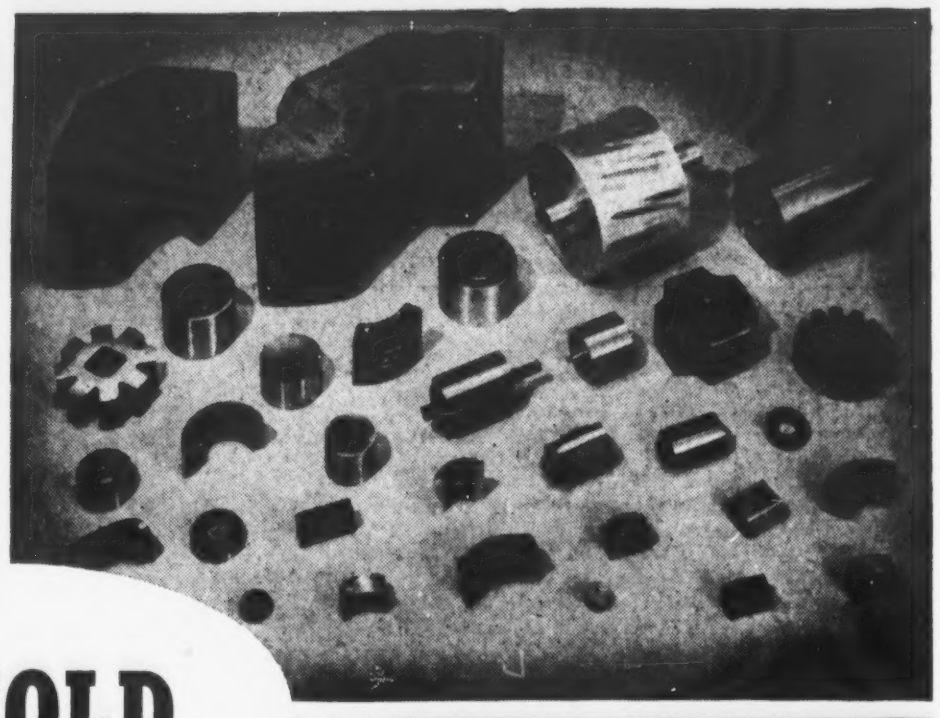

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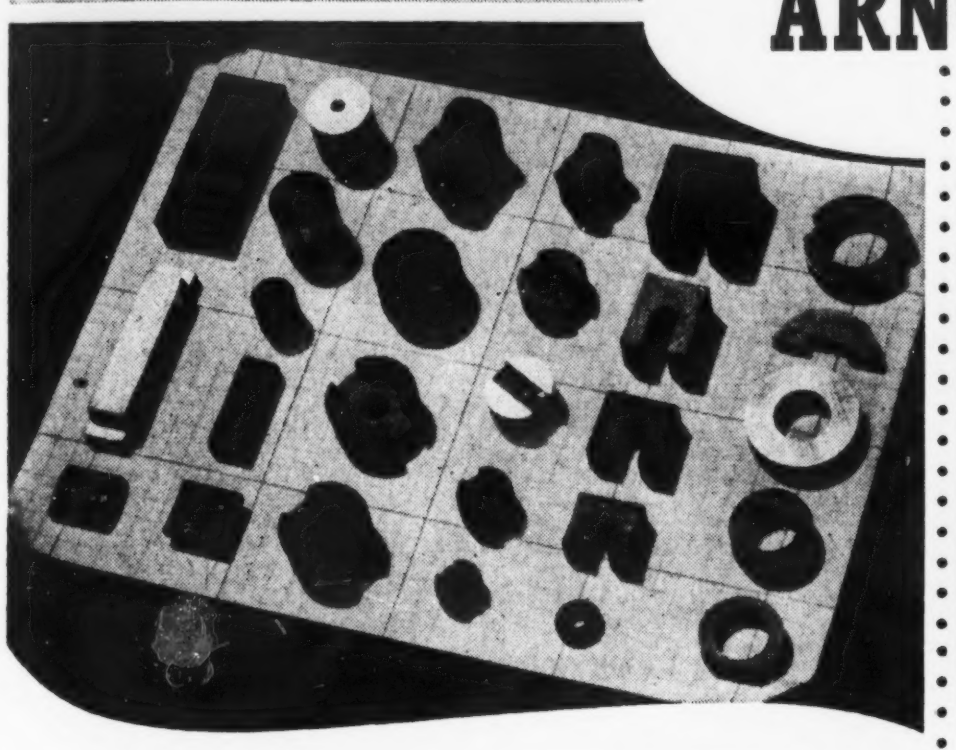

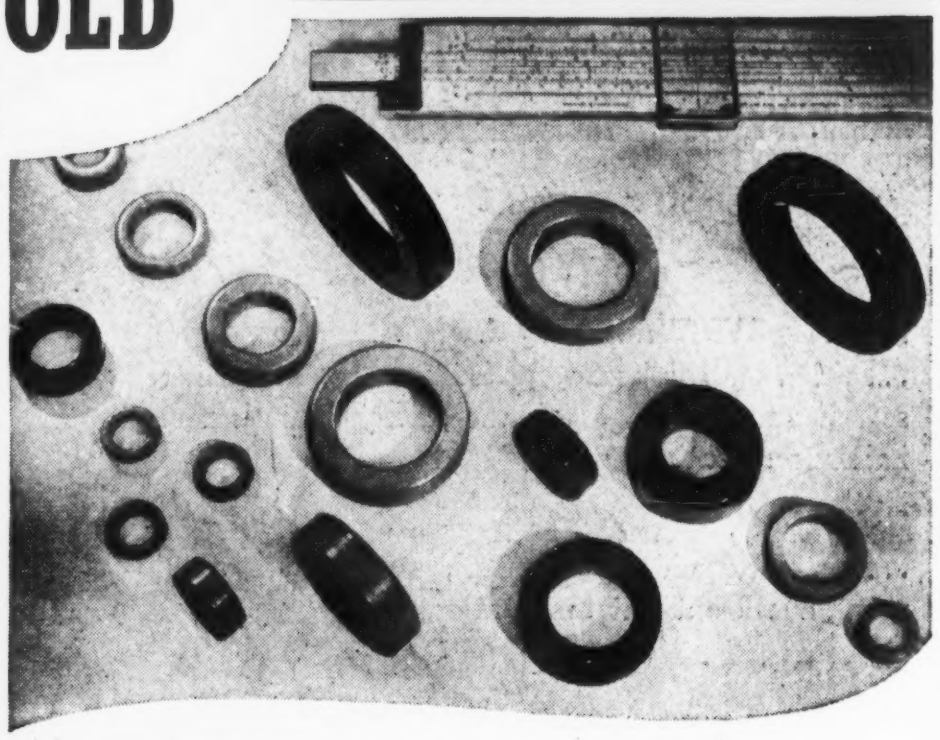

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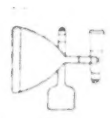
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The Effects of a Nuclear Explosion on Commercial Communication Equipment

by Raymond H. Williamson
Chairman, FCDA-RETMA Atomic Test Committee
and
Manager, Engineering Administration for Communication Equipment
General Electric Company

Operation Teapot took place on May 5th at Yucca Flats. For this test, thirty communication equipment manufacturers, under the sponsorship of the Radio-Electronics-Television Manufacturers Association, cooperated with the Federal Civil Defense Administration by supplying materials and manpower to obtain information on the effects of a nuclear explosion on commercial equipment. This is the first published report on how this equipment stood up under the impact of a 30-35 kiloton blast.

THE MANUFACTURERS OF communication equipment have long recognized the importance to national defense of obtaining information on the effects of a nuclear explosion on typically-located commercial communication equipment.

As a public service, the Radio-Electronics-Television Manufacturers Association (RETMA) accepted an invitation from the Federal Civil Defense Administration (FCDA) to participate under Civil Defense auspices in Operation Teapot. The test took place during the Spring of 1955 at the Nevada Test Site of the Atomic Energy Commission.

Under the conditions and circumstances of this 30-35 KT explosion, the test demonstrated that *commercial communication equipment is generally much more resistant to nuclear effects than some typical residential structures.* Therefore, it may be inferred that, unless fire or fallout interdict the area, public communications may be restored within a reasonable time; also, that salvage operations are worthwhile in order to regain usable communications equipment for use elsewhere.

Need for the Information

Without communications, Civil Defense can hardly operate or fulfill its responsibility for warning and informing the public. The effect of a nuclear explosion on typical commercial electronic and communication equipment has been a matter of great concern to Civil Defense planners. They needed to know what could be expected to remain of public communication facilities necessary to control a civil evacuation after a blast.

In Operation Doorstep at the Nevada Test Site in 1953, the FCDA dramatically demonstrated the devastating effects of a 15-kiloton (KT) * nuclear explosion on a furnished home of typical construction, complete with mannequins, located 3500 feet from ground zero. But these home furnishings did not include many items necessary for the continuance of our civilization, among them communication equipment.

The communication equipment exposed in Operation Teapot was typical of that used in the United States for mobile radio communication systems, broadcasting systems, small telephone exchanges, sound equipment and warning sirens. Also, typical component parts were assembled in actual or simulated end-use electronic products and exposed to the blast.

For purposes of comparison, identical products were exposed at two different distances from ground zero, where possible. These distances were approximately 4700 feet (0.9 mile) and 10,500 feet (2 miles). At the locations chosen, it was expected that prompt radiation would present no problem. However, it was predicted that the over-pressure or blast wave (and its by-product of falling structures) would result in moderately severe damage at the closer location and light damage at the two-mile zone.

It was expected that several by-product benefits would result from the tests. They should reveal the type of product design which would best withstand the effects of a nuclear explosion in this range and disclose mechanically weak spots which might be "beefed up" without substantial increase in cost. Also, it was planned

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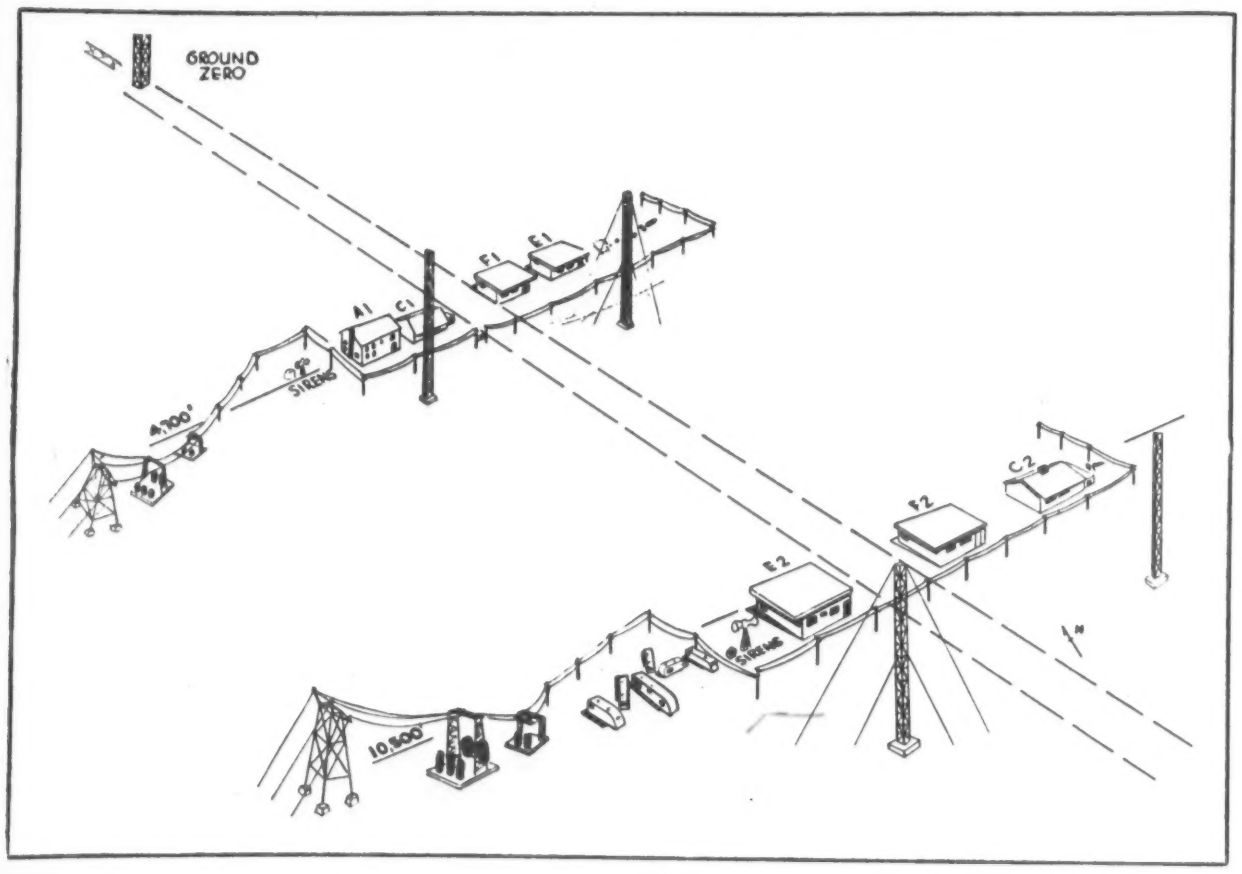
This is an informal report. An official test organization report of this project is in preparation and will be released through the Civil Effects Test Group, Operation Teapot.

Plot plan of area exposed to 30-35 kiloton blast during Operation Teapot.



**That is, equivalent to 15,000 tons of TNT. The Hiroshima bomb was 20 KT.*

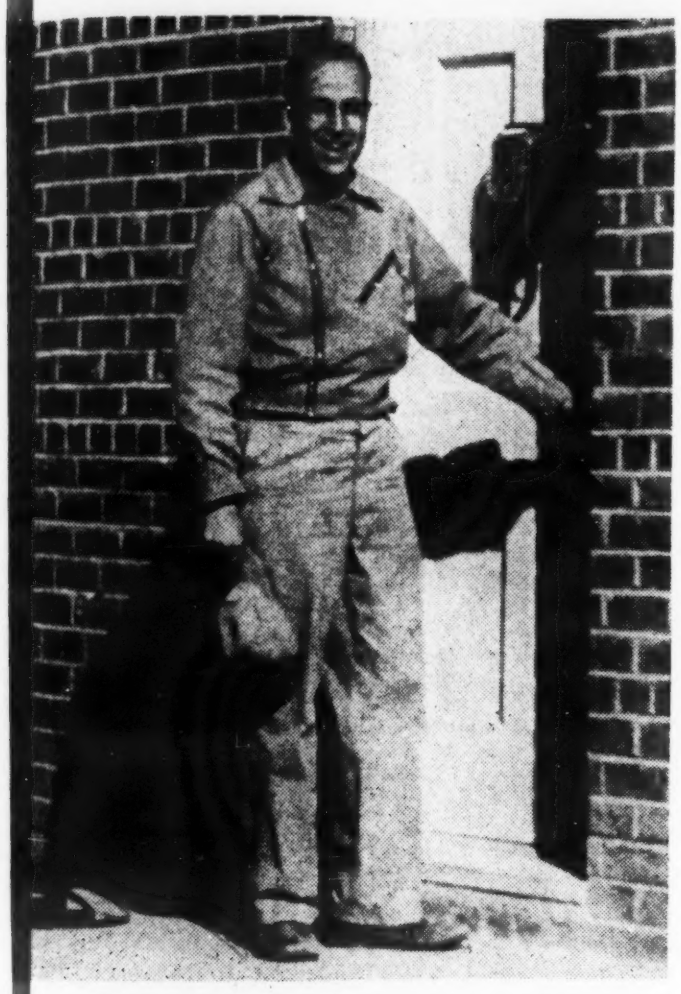
that the test would disclose types of building construction and locations within or near buildings, which are to be preferred for survival of communication equipment.

Physical Arrangement

The Area Plot Plan (see cut) shows the arrangement of the test houses on either side of the blast line. These houses were built along two arcs with the 500-foot explosion tower at Yucca Flats as center, one arc at 4700 feet and the other at 10,500 feet. The blast line was chosen in such a direction as to minimize radiation "fall-out" problems.

Within and near the houses, communication equipment products were placed in situations that approximated, as closely as possible, the placement of such equipment in commercial buildings and in homes.

House A1, 4700 feet from ground zero, was a two-story, centerhall, brick structure with basement and had outside walls built up of one outer layer of brick with 4-inch cinder block backing. It was typical of much construction throughout the nation.



The author standing at the entrance to brick house A1, 4,700 feet from ground zero.

Houses C1 and C2, located 4700 feet and 10,500 feet respectively from ground zero, were the single-story, frame (rambler) type, without basements and built on concrete slabs.

Houses E1 and E2 were located 4700 feet and 10,500 feet respectively from ground zero. These single-story, basementless homes were constructed with precast concrete walls on concrete pier footings, with poured concrete floor slabs and precast concrete roof slabs. The design conformed with earthquake requirements and is FHA approved.

Houses F1 and F2, located 4700 feet and 10,500 feet respectively from ground zero, were single-story, basementless buildings made of 8-inch masonry block, steel reinforced. The design conformed with California earthquake requirements and is FHA approved. These houses were built on concrete slabs and, in addition, had precast concrete slab roofs.

Class	Number of Items 4700 ft.	10,500 ft.
*Mobile Radio Communication Systems & Units	25	21
*Standard AM Broadcast Transmitting Station	8	—
Antenna Towers	2	2
Home Receiving Systems	14	13
Telephone Systems	10	2
Sound Systems	12	12
Component-Part Exposure Panels	8	4
Wire and Cable	8	5
Sirens	2	2
TOTAL	89	61

Classes of communication equipment exposed to the blast. The list includes several small items not separately discussed in the article, such as headphones, microphones and monitors. Asterisks indicate that product descriptions, test results and observations are given in this article for these two classes.

Pre-Blast Inspection and Operational Tests

All exposed products were operated and successful performances secured before the blast. When appropriate, FCC station licenses were obtained and brief but realistic "over-the-air" operational communication tests were made.

Plans required that the Standard AM Broadcast Station should be on the air approximately seven hours before the nuclear explosion, broadcasting a repetitive tape recording of voice.

Mobile Radio Communication Systems and Units

Two-way mobile radio is an extremely important part of the communications needed during an emergency. Therefore, a variety of products for such systems was exposed.

Five base stations for mobile radio systems were installed and tested over the air with associated mobile stations. A portable gas-engine generator was used for 60-cycle power supply. These base stations are described in Table 1.

When brick building A1 collapsed, the transmitter-receiver consolette of base station No. 1 fell from the second floor about 12 feet and landed upside down on rubble. The case was slightly warped, the top was missing and the front panel was bowed a little. When power was applied, two-way communication was established with nearby mobile station No. 1 without servicing.

Base station No. 2, including its remote control unit, was extracted from underneath the roof and second floor debris of house A1 with the aid of a large crane. The large door of the transmitter-receiver cabinet was sprung so that it could not be opened until later when heavy tools were available. However, the remote-control unit and temporary power were connected and two-way communication was established immediately with nearby mobile station No. 2 without servicing.

Base station No. 3 suffered no mechanical damage, since the basement ceiling did not fall. The equipment was subjected to a heavy fall of fine dust. After the explosion, temporary power enabled immediate communication with nearby mobile station No. 3 without servicing.

Base stations Nos. 4 and 5 had only superficial damage due to flying glass, and were immediately operable.

Table I. Base stations for mobile radio systems.

Base Station No.	Mfgr.	Distances to Ground Zero (Feet)	Location	Transmit Frequency (MC)*	Power Output (Watts)
1	RCA	4,700	A1 Second Floor	35.5	60
2	GE	4,700	A1 Ground Floor	35.5	60
3	Motorola	4,700	A1 Basement	152.03	30
4	GE	10,500	F2	35.5	60
5	Motorola	10,500	F2	152.03	30

*Megacycles per second.

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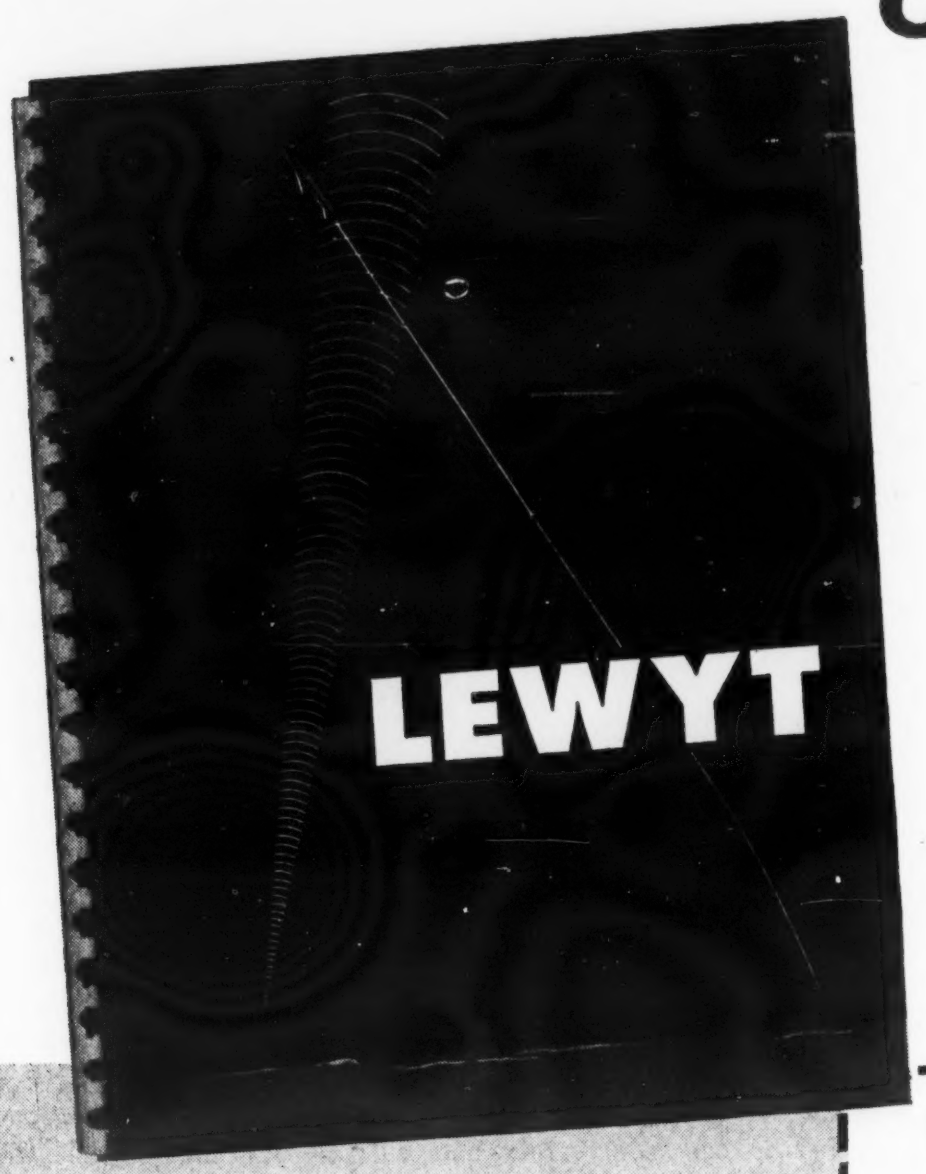

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Antennas Exposed to Blast

Twelve antennas for mobile radio base stations were installed on steel towers and two on buildings. Five were tested in actual over-the-air communication with associated mobile stations. These antennas and associated coaxial cables are described in Table 2.

No base-station antenna or transmission line was seriously damaged except by the falling of the top 80 feet of the 120-foot supporting tower behind brick house A1. The only direct explosion damage was the bending of some antenna members. The amount of bending due to overpressure would permit use of the antenna, and the members could be straightened by hand when convenient. Thermal radiation did minor damage by scorching some plastic weatherproof jackets on coaxial cables which were in direct line of sight to the explosion. Such scorching, while not enough to interfere with present operation, might eventually deteriorate and crack the insulation enough to admit water.

Antenna No. 1 was damaged. The falling section of the tower struck it and broke off one ground rod. The vertical whip was bent about 25 degrees, with about 5 degrees bend above each step of size reduction, indicating these points are weakest mechanically. It could have been restored to temporary service by hand-straightening the members and remounting it on a new bracket.

Antenna No. 2 was unusable and could have been restored to use only with difficulty, since it fell from a 100-foot elevation with the tower and hit the ground. All major members were bent. It is estimated that one man-hour of reshaping antenna elements would place it in a condition for emergency use.

Antenna No. 3 rode the broken tower down from a 70-foot elevation, stopping about 10 feet above ground. The whip was bent about 30 degrees at the base, probably due to the fall. The transmission line was not broken.

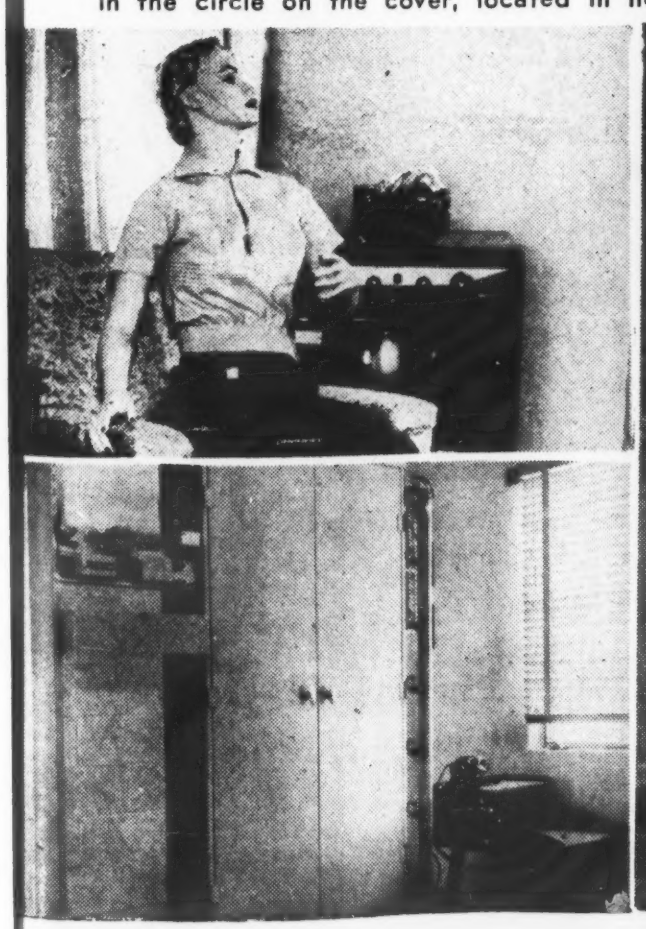
Wraplock used to mount antenna No. 4 was torn in two. At other points, wraplock used to mount coaxial cable was loosened by slipping through the clamps. Such failure and slippage occurred only under the high-stress conditions of tower collapse.

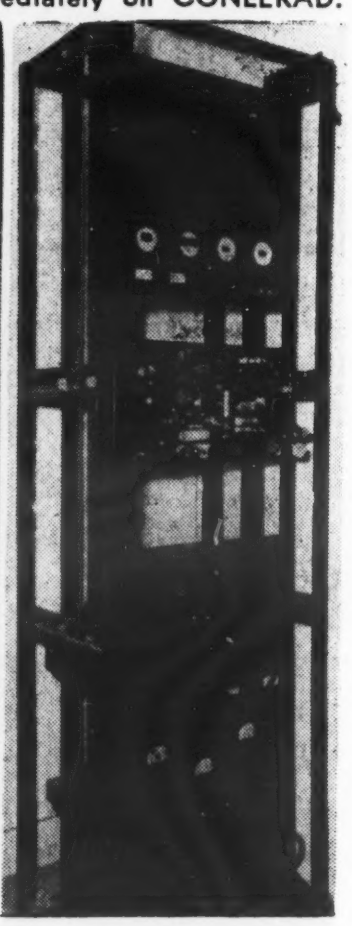
Similar observations apply to antennas No. 5 and No. 6. Both were operable, although No. 5 had been hit by the falling tower. Antenna No. 7 was located in the debris of house C2 and appeared to be intact. Mobile communication antennas at 10,500 feet were not damaged by the explosion.

Antenna No.	Mfgr.	Distances to Ground Zero (Feet)	Location Bldg.	Location Tower	Height above Ground (Feet)	Frequency (MC)	R-F Feed Cable, Type
1	RCA	4,700	A1	120-foot	40	35.5	Coaxial
2	Andrew	4,700	A1	120-foot	100	35.5	Heliax
3	Motorola	4,700	A1	120-foot	70	152.03	RG-8/U
4	Ant. Spec.	4,700	A1	120-foot	40	120-176	----
5	Andrew	4,700	A1	120-foot	40	30-44	----
6	Motorola	4,700	A1	120-foot	40	152-174	----
7	Amphenol	4,700	C1	Roof	15	162-174	----
8	Ant. Spec.	10,500	F2	100-foot	20	30-50	----
9	Andrew	10,500	F2	100-foot	80	35.5	Coaxial
10	Motorola	10,500	F2	100-foot	50	152.03	RG-8/U
11	Ant. Spec.	10,500	F2	100-foot	20	120-176	----
12	Andrew	10,500	F2	100-foot	20	30-44	----
13	Motorola	10,500	F2	100-foot	20	152-174	----
14	Amphenol	10,500	C2	Roof	15	162-174	----

Table II. Antennas for mobile radio base stations.

"Before" views of pictures on the cover. Upper left, a television receiver (G-E) and mannequin on the groundfloor of house A1. The cover shows the set after the blast. It was operable without servicing, although the appearance had been damaged. Lower left, before view of a (North Electric) suburban dialing telephone exchange, placed in test operation in building F1. Operation was restored after a few minutes' servicing. On the cover, notice that the top and bottom trim strips have been blown away. The 120-foot unguyed tower, located behind house A1, supported six mobile radio base station antennas. The blast wave caused peculiar metal fractures and failure of the tower. The component parts exposure rack, located in house F1, contained products of six manufacturers. Visual inspection disclosed substantially no damage from the blast. The (Admiral) portable radio in the circle on the cover, located in house C2, operated immediately on CONELRAD.





Mobile Stations Checked

Six mobile radio stations in automobiles were installed and tested over the air with their associated base stations. All cars were located between buildings with trunks facing ground zero. Car windows were closed. These mobile stations are described in Table 3.

The tops of all cars were dented inward. The cars on the 4,700-foot line were more severely dented and suffered other damage such as windows blown out, trunk lid torn off, hood up, etc.

Car No. 2 was flattened and driven partly into the ground by a falling chimney from house A1. The falling chimney flattened the receiver severely. The mobile radio units were recovered. In order to place the receiver in operation, it would have been necessary to secure a vibrator and several tubes and perform about four hours of servicing. The transmitter case was damaged, but the unit operated, as did the cables and control equipment. The nylon screen inside the microphone was scorched by thermal radiation.

The whip antenna was broken off completely and driven partly underground. Equipment in other cars operated without servicing.

Four hand-carried transmitter-receiver units (transceivers) and six monitor receivers were installed and operated. These units are described in Table 4.

The antennas of equipment Nos. 1 and 6 were subjected to appearance damage due to flying glass. Receiver No. 3 was located on top of base station No. 2, and had its case damaged by the falling of brick house A1; it operated successfully after the explosion, however. Receiver No. 4 was lost in the wreckage of house A1. Receiver No. 5 was deformed by the collapse of house A1, but operated after the blast; its whip antenna was lost in the rubble.

Units at the 10,500-foot line were not damaged appreciably.

Standard AM Broadcast Transmitter Station

This station was composed of conventional units of RCA manufacture, including:

250-watt amplitude-modulation (AM) broadcast transmitter tuned to 1240 KC (Conelrad frequency); table-mounted audio consolette and its wall-mounted power supply; electrical transcription machine (not operated); tape recorder; modulation monitor; frequency monitor, and test equipment including a cathode-ray oscilloscope and vacuum tube voltmeter.

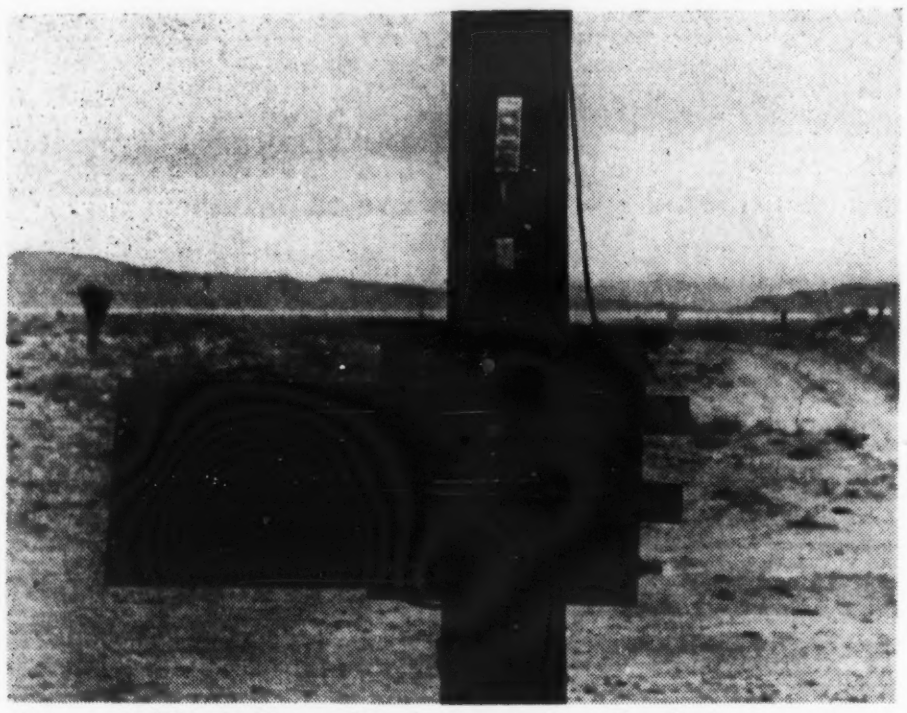
Sixty-cycle power was obtained from a 5kw gas-engine-driven generator located in a pit behind house E1. The power was carried from a pole near house E1 into house F1 on overhead wires which were part of another project: "Effects of Atomic Weapons on Electric Utilities."

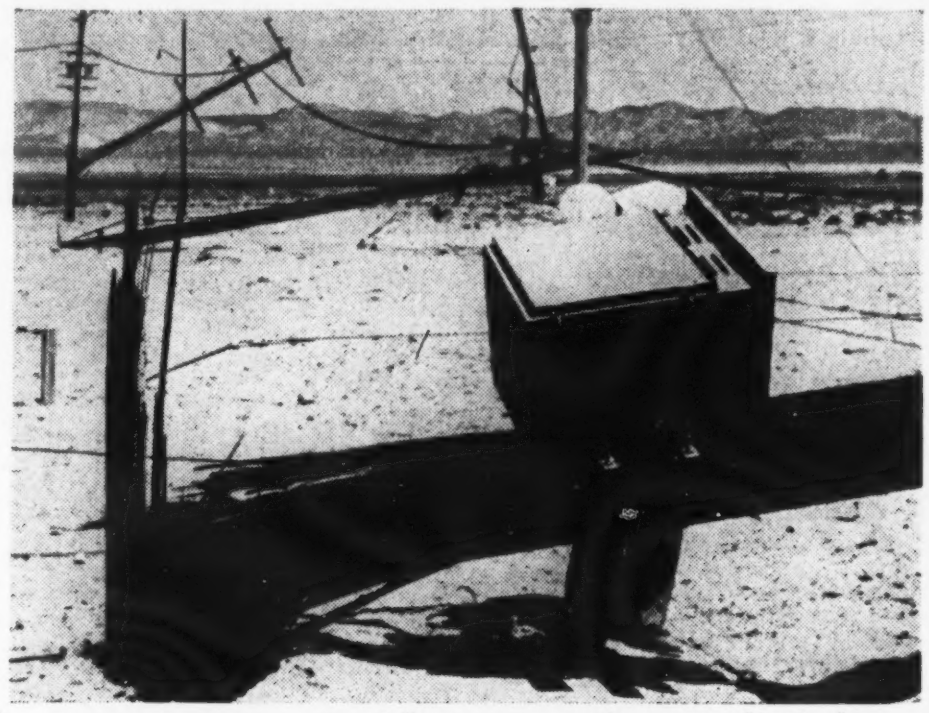
Radio frequency energy was carried by RG-17/U flexible coaxial cable from the transmitter in house F1 to the 150-foot guyed vertical radiator antenna behind house E1. Several control wires for automatic cameras on this tower were carried across the base insulator by winding them into a radio-frequency choke coil, self-resonant at the operating frequency of 1240 kc. The radio-frequency ground system consisted of buried No. 10 copper wires radially disposed about the tower base.

The transmitter was manually turned on each night about seven hours before explosion time. Automatic control signals from the control point were set to turn off the radio-frequency carrier one minute before blast time, and a locally energized timer was supposed to re-start the carrier three minutes after the explosion. The transmitter did not restart after the blast due to the failure of 60-cycle power; the generator stopped and the service wires broke when the pole line overturned. On the afternoon of shot day, three men worked 15 minutes to start the generator and run an emergency power line to the station; five minutes later the transmitter was back on the air broadcasting the tape recording. No tube replacement or other servicing or retuning was necessary. The recorder tape was not broken.

The building protected the transmitter from the explosion to a marked degree. However, the table was blown out from under the audio consolette, allowing it to drop some 30 inches to the floor, where it rested on its back. No wires or switches were broken and it operated successfully in this position. The electrical transcription machine overturned and the mechanism fell out. It did not appear operable. The cathode-ray oscilloscope operated successfully.

The tape recording of voice was broadcast repetitively and consisted of a three-minute message followed by two minutes of silence. It announced the call letters KO2XDM, described the reasons for the transmission and solicited reports of reception. Because of postponements of the detonation due to weather conditions, some 30 total hours of program operation of this transmitter took place. Twenty-four reports of reception were received from various places in the western half of this country and Canada.





Views of (North Electric) pole-mounted rural telephone-carrier assembly behind house F1. The falling power pole snapped telephone service to F1, as well as power service feeder to broadcast station, keeping it off the air until emergency feeder was installed.

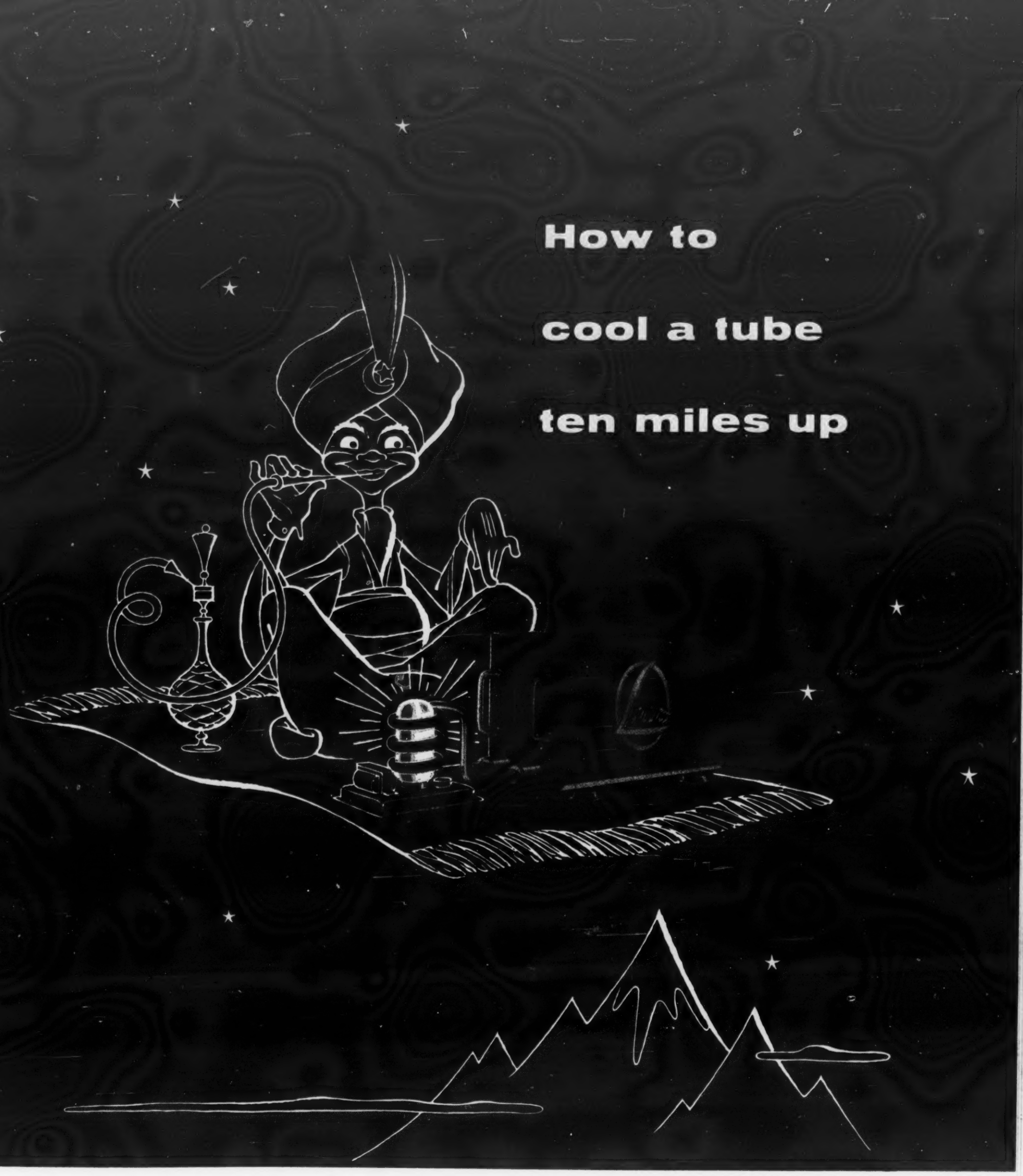
Results and Considerations

Mechanical failures were very few. Scuffs, scratches, minor surface

(*Continued on page* 20)

Table III. Mobile radio stations.

Mobile Station No.	Mfgr.	Distances to Ground Zero (ft.)	Location	Automobile	Transmit Frequency (MC)	Power Output (Watts)
1	RCA	4,700	West of F1	1941 Chevrolet	35.5	30
2	GE	4,700	West of A1	1949 Ford	35.5	60
3	Motorola	4,700	West of A1	1951 Plymouth Cab	158.47	10
4	RCA	10,500	West of C2	1941 Cadillac	35.5	30
5	GE	10,500	East of F2	1947 Buick	35.5	60
6	Motorola	10,500	West of F2	1951 Plymouth Cab	158.47	10



Why do you *have* to cool an electron tube at altitudes where air temperatures hover near 65° below?

Well, take, for example, the high-input tubes in certain critically important equipment built by the W. L. Maxson Co. for our first-line strategic bombers. In a matter of seconds, these tubes can get really hot—hot enough to melt! Stratospheric air, cold as it may be, is just too thin to dissipate so much heat so fast.

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scorching, gouges and dents are excluded from consideration since their presence results in no impairment of service.

Plastic cases and knobs on portable radio receivers, TV sets and telephone hand sets were severely chipped and cracked in a few cases when these unattached receivers became missiles or were subjected to falling structures. In no case was performance impaired appreciably. It appeared doubtful whether the plastic cases could be made sturdier without increasing cost. If desired, the test conditions can be successfully simulated in the factory laboratory by simple drop and impact tests.

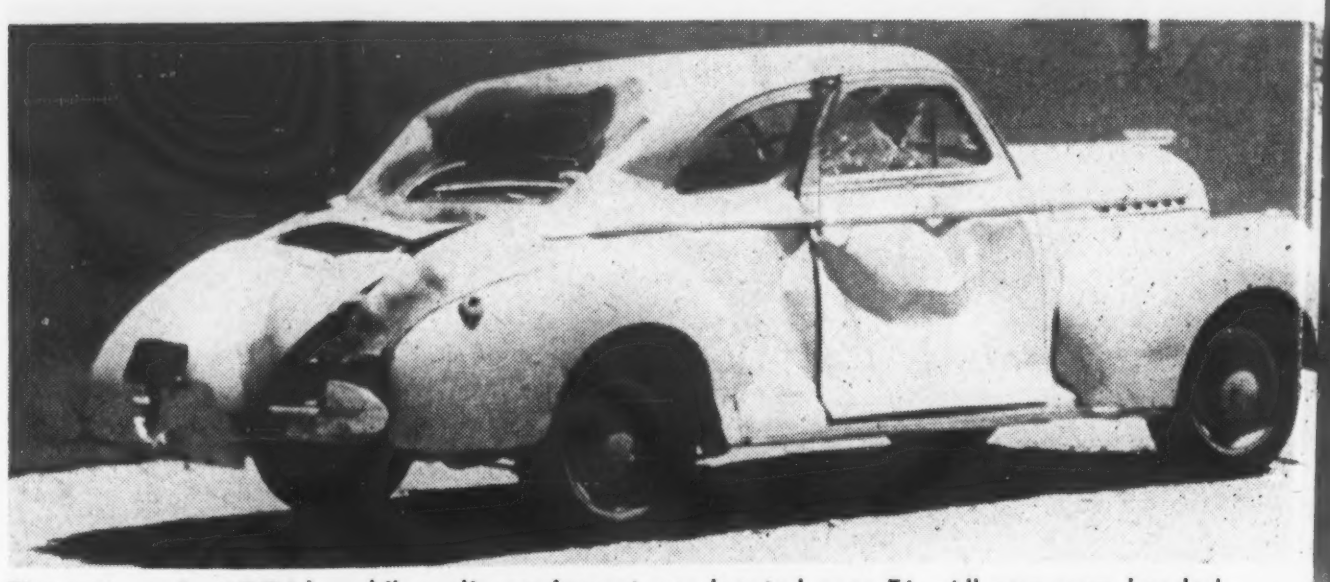
Plastic-covered radio-frequency cable and outdoor telephone wire, used as a service drop at the entrance to a building, were noted to have a small fraction of their surfaces covered with a carbon deposit resulting from flash burning of the insulation. Also, a microphone screen of nylon appeared to have melted in Zone B.

Whip antennas under blast conditions have a tendency to bend or break off at the point of attachment to the car body. Manufacturers may be able to make this section stronger without increased cost. However, a more practical solution lies in maintaining spare whip antenna assemblies for each fleet of cars equipped with mobile radio.

TV receiving antennas generally failed in Zone B due to bending of elements and structural collapse, about as they would be in a hurricane. It was doubtful if manufacturers could design TV receiving antennas to withstand such forces without substantial increase in cost.

In the home and in the car, battery-operated receivers are desirable for emergencies when power lines fail.

The failure of the 120-foot unguyed antenna tower 40 feet above the ground (4700 feet from ground zero) disclosed an unusual design problem which unfortunately is not susceptible to laboratory investigation. All three of the steel tubes "ripped" just above arc welds at a step-taper transition. There was no evidence of elongation, bending or folding. The rips had more of the appearance of fatigue failure than rupture from any other familiar cause, yet there was no evidence that metal fatigue actually existed.



This test car for (RCA) mobile radio equipment was located near F1. All cars were headed away from the blast. The equipment in the car above was ready to be used without servicing after the blast.

Plans for Broadcast Stations

Since communications are so vital in emergencies such as a nuclear explosion, those who plan new buildings for broadcast transmitter stations or mobile radio base stations should consider the sturdiness of the building and the orientation of the building and its rooms with respect to a probable target point in the vicinity. The single-story, reinforced masonry block, basementless type of house (buildings F1 and F2) and the single-story, precast concrete slab, basementless design of residence (buildings E1 and E2) gave fair protection to communication equipment. The two-story, brick veneer, masonry house with basement (building A1) and the single-story, frame rambler basementless house (building C1) gave little or no protection to communication equipment and the collapse of these structures damaged the communication equipment in some cases. If such equipment is housed in a structure which does not collapse, there is a definite advantage in having an inside bearing wall plus the building wall between the equipment and ground zero. However, there should be large-area windows facing both toward and away from ground zero which will blow in or out and thus provide fast pressure equalization, and there should be open doorways or equivalent between inside rooms to provide prompt pressure equalization between rooms and thus avoid collapse of the inside bearing walls. Of course, an underground transmitter building with adequate roof strength would be safer than a surface structure.

In this test, sixty-cycle power supply failure was the cause of the outage of the broadcast transmitter station. A small amount of protection from such an outage may be provided by using underground service wires to the building. If a pole line leans with the blast, the main power lines may be intact while the overhead customer-service lines are snapped. In this test, such conditions prevented the AM broadcast transmitter from coming back on the air three minutes after the blast as planned. Better protection may be obtained by utilizing a gas-engine-driven generator or equivalent as an emergency power supply. Such a machine should be in a well-protected location.

Of about equal failure probability for a broadcast transmitter is loss of telephone-line or radio-link facilities for programming the station. However, many of the emergency functions of a broadcast station may be carried on if minimum studio and control room facilities (at least an announcer's microphone and tape recorder) are located at the transmitter site.

A complete spare studio-to-transmitter radio link is desirable but costly. The use of a tape recorder

Participating Electronics and Siren Companies

Admiral Corp.
American Phenolic Corp.
Andrew Corp.
The Antenna Specialists Co.
Belden Manufacturing Co.
Bendix Aviation Corp.
Cook Electric Co.
Corning Glass Works
Dale Products, Inc.
DuKane Corp.
Erie Resistor Corp.
General Electric Co.
The Hallicrafters Co.
Hughes Aircraft Corp.
Hydro-Aire, Inc.
I.D.E.A., Inc.
J-B-T Instruments, Inc.
Jefferson Electric Co.
JFD Manufacturing Co.
Lenz Electric Manufacturing Co.
P. R. Mallory & Company, Inc.
Motorola, Inc.
The North Electric Co.
Permoflux Corp.
Radio Corporation of America
Remler Company, Ltd.
Simpson Electric Co.
Speer Carbon Co.
Sprague Electric Co.
Stainless, Inc.
Federal Sign & Signal Corp. (siren)
Robert J. Zievers, Inc. (siren)

is very convenient to transmit repetitively important announcements to the public, as was done in this test. Availability of critical spare parts and batteries is important.

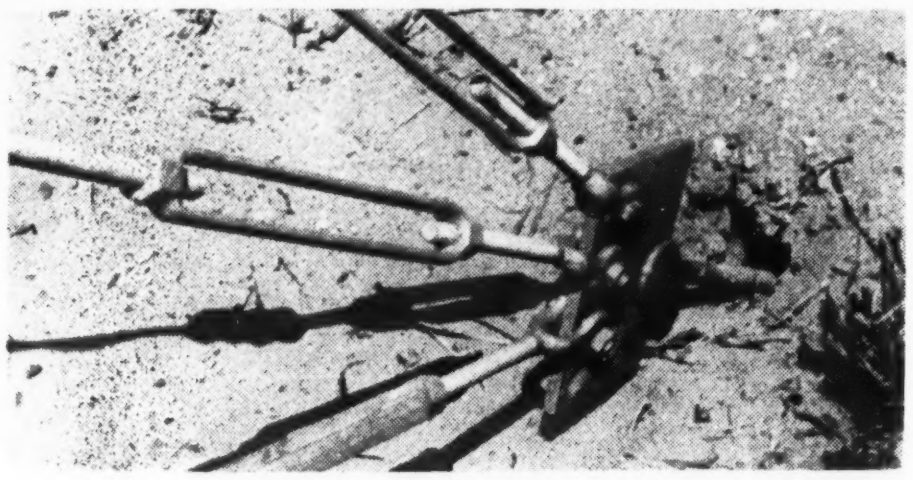
The antenna tower is probably the third weakest link in the chain of reliability for radio transmitting systems, and hence tower strength is not the place to economize if relative ability to withstand the effects of nuclear explosions is desired. These tests did not provide conclusive data for a choice between guyed and unguyed towers.

Transmitter buildings, antenna towers and guy wires should be located to minimize the likelihood of other structures or pole lines falling on them in case of nuclear explosion. Also, consideration should be given to the avoidance of missiles, such as pole-mounted distribution transformers, which might be moving away from the target area.

In planning for a siren warning system, it is desirable to locate sirens away from structures which may collapse under them or fall on them. Sirens placed on top of buildings may be inaccessible for repairs after a nuclear explosion due to a hazardous condition of the building. Sturdy sirens and strong bases are also important. Post-explosion availability

Special Eqpt. No.	Mfgr.	Distances to Ground Zero (ft.)	Location	Class of Equipment	Transmit Frequency (MC)
1	Bendix	4,700	A1 Basement	Transceiver	170.025
2	Motorola	4,700	A1 Basement	Transceiver	158.49
3	GE	4,700	A1 Ground Floor	Monitor Receiver	35.5
4	Hallicrafter	4,700	A1 Second Floor	Monitor Receiver	30-50
5	IDEA, Inc.	4,700	A1 Ground Floor	Monitor Receiver	35.5
6	Bendix	10,500	F2	Transceiver	170..025
7	Motorola	10,500	F2	Transceiver	158.49
8	GE	10,500	F2	Monitor Receiver	35.5
9	Hallicrafter	10,500	F2	Monitor Receiver	30-50
10	IDEA, Inc.	10,500	F2	Monitor Receiver	170.025

Table IV. Transmitter-receiver units and monitor receivers.



Anchor arm with three guy cables attached for (Stainless, Inc.) 150-foot broadcast tower, at 4,700 feet. Note the neat hole in dry sand around anchor arm, apparently caused by severe oscillations of tower and cables at blast time.

of three-phase, 220-volt power is another important consideration in the location of sirens.

Civil Defense Guide

The FCDA has published* scaling charts and tables from which, given the assumed enemy bomb yield, the approximate positions of the four concentric zones of destructive effects may be predicted. These concentric zones are A, B, C and D which correspond to rings of progressively less damage as we proceed outward from ground zero.

For convenience in the use of the statements which follow, italicized new statements regarding damage to communication equipment appear for each zone, together with paraphrased samples of previously published FCDA statements about other classes of exposed items.

Zone A—Ordinary American city buildings are virtually completely destroyed; highways and streets are impassable; vehicles are unusable. (For Operation Teapot, Zone A extended from ground zero out about 0.6 miles. Present test data on communication equipment to Zone A are too speculative for inclusion.)

Zone B—Ordinary buildings are destroyed or damaged beyond repair; highways and streets are impassable; vehicles are generally unusable; *communication equipment is moderately damaged, generally usable with minor on-site servicing; home receivers (TV and broadcast) are generally usable without servicing, but most TV receiving antennas are damaged beyond repair. Some towers for radio transmitting antennas are damaged beyond use although sturdier towers may be usable.* (For Operation Teapot, Zone B extended from about 0.6 miles to 1.2 miles, bracketing the 0.9-mile distance where one set of equipment was exposed.)

Zone C—Ordinary buildings are damaged beyond repair or are moderately damaged but must be vacated for repairs; many parts of highways are blocked by rubble; some vehicles are unusable; *most communication equipment is usable, generally without servicing; towers for radio transmitting antennas are not damaged.* (For the present tests, Zone C was the ring between about 1.2 miles and 1.8 miles.)

Zone D—Ordinary buildings are partially damaged but need not be vacated during repairs; some parts of streets and highways require clearing of rubble before use; most vehicles are usable; *all communication equipment is usable with substantially no servicing; towers for radio transmitting antennas are not damaged.* (For Operation Teapot, Zone D extended from about 1.8 miles to 2.2 miles from ground zero, including the 2-mile exposure location for the other group of equipment.)

The area outside Zone D is the assumed dispersal area.

Acknowledgments

The author expresses sincere appreciation to the many individuals and organizations who made this project possible. Overall sponsorship and a framework for advance planning were provided by FCDA and RETMA. Thanks are due particularly to R. L. Corsbie, Director of the AEC's Civil Effects Test Group, to A. H. Stevenson, Director of FCDA Program 35, and to Dr. W. R. G. Baker, Director of the RETMA Engineering Department. A most personal appreciation is felt for the work of the thirteen field engineers from ten companies who actually carried on the communication equipment project at Yucca Flats.

**Blast Damage From Nuclear Weapons of Larger Sizes,* FCDA Technical Bulletin TR-8-1, published 1955 by U.S. Govt. Printing Office, Washington, D.C.

Quotes in Review

a survey of major statements made during the past two months

"Our military might is the indispensable shield behind which we and the other free peoples of the world may, through the wise and industrious application of our collective talents and resources, build a decent and stable order of world society. But if we do not provide the shield, it matters not at all what other plans and pursuits we may undertake.

"Now the really significant thing about this greatly enlarged peacetime role which the military must play is that it is likely to be an enduring feature of our national society, at least for as long as we are able to foresee. We have thus to reckon with the long-term problems which focus upon the defense of a nation which is neither at war, not yet at peace. We have to face the worst of war's dangers while lacking the sense of urgency and unity which the actuality of hostilities confers.

"In this strange climate, we have to maintain armed forces which are partly volunteer and partly inducted. Within the social context of a democracy, we have to maintain a large and conspicuous fraction of America's manhood subject to the law and discipline of an organization which is inherently and necessarily autocratic in its nature. We have to maintain at peak efficiency an establishment which suffers an annual personnel turnover which would be ruinous to any business. We must spend billions for death-compelling weapons, knowing that their purpose is best served by securing the conditions that make their active use unnecessary."

Robert B. Anderson
Former Deputy Secretary of Defense
Armed Forces Staff College

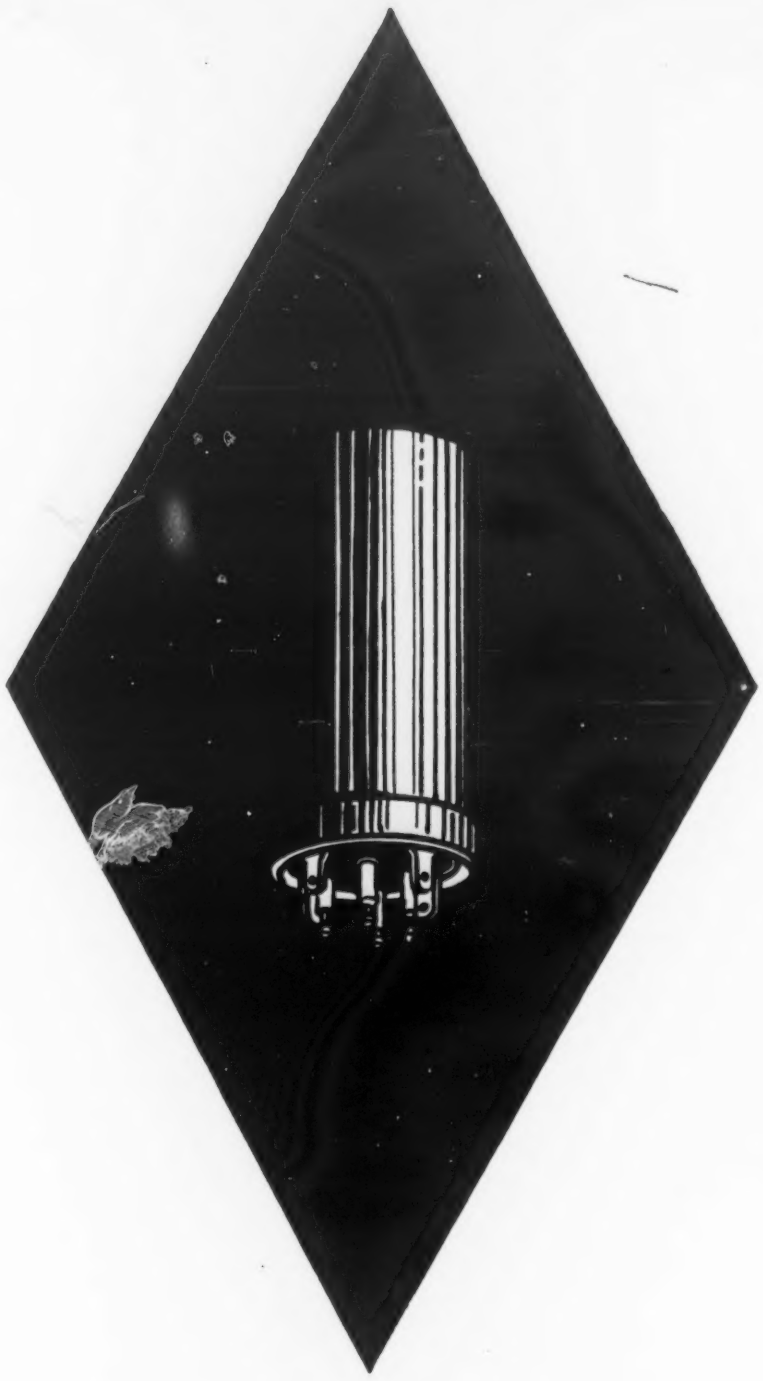
"As a result of the application of electronic techniques of control and computation to the relatively well established field of design of automatic equipment, modern automation possesses two very important basic properties. The first of these properties has to do with the character of the equipment. There is one thing that nearly all factory control, process control, or data-processing problems have in common—they require the employment of electronic and electro-mechanical equipment of a high degree of technical complexity.

"I wonder how many of you have stopped to reflect upon the tremendous change that has occurred since the beginning of the last war in our attitude toward complex electronic equipment. In 1941, the most complicated piece of electronic equipment that anyone had considered using in any extensive fashion was a television receiver, and one of the reasons the practical advent of television had been stalled for several years was that so many people were afraid of its technical complexity. Why, almost 30 vacuum tubes had to be made to work together all at one time; not only that, but the operating characteristics of the components had to be maintained with a degree of precision that was frequently well beyond the then current state of the electronics art. Even many of the more sophisticated in the electronics field seriously questioned whether the maintenance and reliability problems could be solved for such extraordinarily complicated apparatus. By comparison, the assemblage of electronic gear that goes into a typical automation system today employs hundreds and sometimes even thousands of vacuum tubes or their equivalents, together with the associated electronic and mechanical components.

"What has happened in the years since 1941 is that *military necessity* has forced us to devise and employ exceedingly complex electronic equipment. As a result, we are all much less frightened by such things than we would otherwise be. This is partly because electronic equipment has been made more reliable, partly because we were too much afraid of it before the war, and partly because familiarity has bred in all of us a certain amount of brashness. The result is a willingness to attempt to make very complicated equipment work, at least in situations where we are convinced there will be a big pay-off if we succeed.

"I think it is quite safe to say that the fact that this discussion of the immediate implications of modern automation to business and industry is being held in the year 1955, instead of the year 1960 or 1965, is a direct consequence of this recent national experience. Regardless of the technical arguments, I doubt if very many of us in the electronic field would be talking about such complex equipment seriously today, and I feel certain that very few of the non-technical business and industrial customers

(*Continued on page* 24)



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would be listening to us if we did, if it were not for the confidence that has been generated through the military electronics experience.

"So much for the first important characteristic of the new automation—its employment of very complex equipment, largely electronic in character. The second basic aspect of automation is that the equipment, complex though it may be, is rarely an end-item in itself, such as a radio or an automobile, but usually appears as a component that is integrated into a complex system involving men, machines, methods, and procedures—all organized to perform some basically non-technical operation. In other words, *automation equipment is best thought of as a tool.* Like any tool, proper design of an automation system requires that the greatest of attention be paid to the special needs and capabilities of the men and organizations that are to use the tool, and that the tool be designed specifically for use in the environment comprised of the other machines, methods, and procedures that characterize the entire operation.

* * * * *

"Having made some attempt at a description of the characteristics of modern automation, it is now my assignment to peer intently into the crystal ball and develop profound prognostications as to the nature of things to come. In a general way, this is very easy to do. Ultimately, a major portion of the processing of data that now occupies the routine attention of many thousands of people will be accomplished automatically. Similarly, a large fraction of the routine repetitive activities of factory workers will be done by the use of the new automation techniques. Direct results of this spreading industrial revolution will certainly include a large increase in our national productivity. Indirect results will include the appearance of new products whose design and production are for the first time made economical because of automation. Automation will become one of the largest—possibly even the largest—national industry. Hundreds of thousands of people will be employed by the companies engaged in the various ramifications of automation, and the annual sales of this important new industry will be reckoned in billions of dollars."

Dean E. Wooldridge
President, The Ramo-Wooldridge Corp.
Symposium on Electronics and Automatic Production

"This is a nation of large, complex industry and a large, complex military establishment. Sheer size and the dynamic nature of modern enterprise presents enormous problems of organization and communication to executives in both industry and the military. So many activities are going on simultaneously, and situations change so rapidly, that it becomes difficult to make decisions based on current, valid information. Paperwork often cannot be conducted fast enough to process the information transmitted by information networks. This is an extremely serious situation in regard to military operations, where time is often such an all-important factor.

* * * * *

"It is difficult to overestimate the importance of these possibilities in a nation where so much depends upon accurate planning and decision-making. The *introduction of automation* into the economic side of military affairs, which we call logistics, is greatly increasing the ability to plan and carry out programs that accurately reflect military needs. Since warfare has become progressively more expensive in terms of expenditure of resources, the degree of our national security is closely tied to this ability.

* * * * *

"The Office of Naval Research has sponsored research programs in this field since 1948. Our objectives are to determine the ways in which automatic data-handling equipment can be used and to develop a system that is tailored for this job.

"In summarizing the Navy's objectives in the application of automation to logistics, let us look first at some of our problems in the supply field. The Navy's supply system employs units called supply and demand control points, which are the decentralized controls over certain categories of commodities. There are twelve, and each one is responsible for a category of material, such as aviation supplies or electronics materials. They control the procurement and inventory of all material in their respective categories. They neither stock it nor physically handle it, but they are the responsible point for keeping records from which they can measure the demand and set the level of inventory.

"They must tread the fine line between the costs of overstocking, on the one hand, and the risks of being caught short, on the other. Because of the enormous variety of items in the system, and a fluctuating demand, their problems are enormous. Efficient operation of these control points depends upon accurate, up-to-date information from the depots and other activities which issue the items.

"The punch-card systems now in use cannot process this vast quantity of information rapidly enough to keep our supply system on a day-to-day basis even in peacetime, let alone during war. The issuing activities now report the status of their stocks on a quarterly basis. As a result, the control point does not have current information and must keep excess stocks on hand to account for the delay in filling needs, due to this information lag.

"The other extreme, from the quarterly reporting of stock status, would be to make item-by-item reports—as an item was issued from stock, a report would be made. This, of course, is not feasible. A workable solution in between these two extremes would be to have daily reports made by each issuing activity. If this can be done, the control point will be able immediately to reflect changes in the status of supplies and know at any time the current status of any item in the system.

"This would place even greater demands upon the data-handling system at the control point, which is a problem even now. Information from all of the depots accumulates rapidly. *Without automation it is impossible to take full*

advantage of these data to initiate procurement action that is a reflection of current needs in the supply system.

"The wartime effects of automation in our supply system would be even greater. Inventory levels could be reduced with less danger of being caught short by sudden fluctuations in demand. The current information on the status of the system could mean the difference between a successful and an unsuccessful campaign, since deliveries could be quickly shifted to meet suddenly changing needs.

"Such shifts could be made only if transportation were available, of course, and this points out another area where automation in logistics can strengthen our defenses. During World War II it was impossible to prevent a certain number of railroad bottlenecks, because there was no way to obtain and process information fast enough to see in advance where a bottleneck would develop, and divert shipments somewhere else. Only through automation will it be possible to know exactly what is in transit throughout the transportation system, and what its priority is. Being able to make decisions on the basis of current, complete information would be of even greater value if parts of the transportation system were to be damaged, and cause a need for immediate rescheduling.

"Automation of military supply systems through use of electronic computing equipment would also reduce manpower requirements. In World War II, when rapidly expanding operations caused routine paperwork to mushroom, it was necessary to hire and train large numbers of people to handle the load. This was not only a drain on manpower, but it caused many errors due to inexperienced personnel. It is logical to assume that, with a high degree of automation in the system, once peacetime requirements had been established and were being handled fairly smoothly, the increased wartime load could be handled by more intensive use of the computers. If they were operated on a three-shift basis, a much greater load could be handled with a relatively small increase in trained personnel.

"The second area in which automation has great implications for logistics is in planning. Every nation has a certain amount of resources in manpower and materials. Its capacity to conduct military campaigns is limited by the amount of these resources. They affect not only the extent, but also the timing of operations. It is extremely important to be able to estimate what demands on national resources will be made by a given strategic plan. More than this, it is important to be able to estimate all of the logistic complications of the plan. It could be disastrous for a nation to make strategic plans which it could not carry out because it did not have the resources.

"As a result, the ability to estimate logistic requirements accurately is vital to an adequate national defense effort. Military planning today involves the development of logistic plans along with strategic plans. In our military establishment, the Joint Chiefs of Staff have responsibility for preparation of joint logistic plans.

"In addition to testing the logistic implications of strategic plans, industrial feasibility tests are conducted on these plans to determine whether or not manpower and industrial capacities are adequate to support the plan and to determine the status of the logistic readiness of the armed forces. The results of such tests indicate what deficiencies exist. They help to provide a basis for correcting the deficiencies, or, if they cannot be corrected, provide a basis for modifying the strategic plan.

"This kind of planning generates enormous amounts of data. It *is* possible to do this work manually. It has been done manually in past wars, but only at a great expense in materials and accuracy—a luxury we no longer can afford! We now have mechanical punch-card equipment and other aids to the manual processing of planning information, but these methods are not adequate. They are severely limited in speed, accuracy, and detail. They therefore lead to solutions that are correspondingly limited in flexibility, precision and completeness.

"This is the reason we are anxious to develop automatic means for handling the data generated by logistics planning. We must always bear in mind the extreme importance of time as a factor in military planning. If such an automatic system were in operation, it would be possible to find out quickly whether a given strategic plan generated requirements which were too large. The planner could go back and revise. It would be possible to keep abreast of operations and quickly find logistic answers.

"No computer which could handle such a job has yet been made, but the equipment and the techniques are available. It is only a matter of bringing them together, which is one of the goals of the Navy's logistic research."

Rear Admiral Frederick R. Furth, USN
Chief of Naval Research
Symposium on Electronics and Automatic Production, sponsored by Stanford Research Institute and National Industrial Conference Board, Inc.

"The American economic system is particularly well suited to the translation of our great national resources into weapons for the military inventory in as short a time as possible. However, we can no longer rely on accomplishing this on a crash basis.

"To develop superior bombers and to get them into the inventory requires up to eight years. Advanced engines require five years to develop if they are to have in them the degree of performance and reliability we feel we must have. Complicated communications and fire control equipment are taking increasingly longer to develop.

"We have the finest Air Force in the world today, and if it is to remain the finest as long as the age of peril continues, we must have a continuously high level of invention, development and production dedicated to the proposition that the United States Air Force must be equipped at all times with weapons that are technically as advanced as the state of the art permits."

Roger Lewis
Assistant Secretary of the Air Force
Air Force Association

RADIO RECEPTOR

SPECIALISTS IN PRODUCT ENGINEERING

by Robert D. Eckhouse

FROM THE CRYSTAL RADIO SET TO modern radar equipment is a long way in the radio-electronics field. It spans more than three decades and yet it is a relatively brief period of time when the industry's tremendous accomplishments are taken into consideration.

This is the progressive path that the Radio Receptor Company, Inc. has followed since its organization in 1922. It began by making small but important contributions in the production of super heterodyne radio sets, head sets, public address and central radio systems and is today one of the largest manufacturers of diodes and rectifiers.

In addition, the company is one of the leading producers of dielectric heating machinery and appliances for industrial processing of non-metallics. Its high-speed electronic equipment, called "thermatron," is first in the field of dielectric heaters used in processing products made of plastic, wood, paper, and other non-metallic materials. Radio Receptor's Engineering Products Division, which accounts for half of the company's sales volume, is one of the top producers of communications and navigational equipment for the Government.

Hugo Cohn, president of Radio Receptor Company, founded the firm 33 years ago.

Aids to Navigation

In the middle 1930's, the company pioneered in the use of low and medium frequency radio aids to navigation, and completed many installations for the Department of Commerce and numerous state agencies. These installations included complete radio range systems, beacons and markers. The culmination of this activity came with the beginning of World War II when Radio Receptor Company developed the BC-446 (radio range transmitter). In its many different versions, this transmitter was the cornerstone of radio range navigation in the Airways and Air Communications Service.

Following World War II, the company pursued the field of long-range, low-frequency navigation even further and developed omni-directional range systems. Although these systems were based primarily on the use of phase comparison techniques,

Airport Traffic Console, ANFRC-19B, one of many pieces of navigation and communications equipment made by Radio Receptor Company for the Government is demonstrated here by Ralph Mendel, vice president in charge of the company's Engineering Products Division and Vice Admiral J. J. Clark, USN (Ret.), vice president.

the resultant broad experience in medium and high power low-frequency navigation systems has made possible a high degree of familiarity with long-range navigation systems.

The company made its first micro wave transceiver in 1935 and late in the 1930's it developed the first VHF airborne receivers for the Civil Aeronautics Administration. Since that period it has been extremely active in the VHF and UHF communications field. Successful developments have included ground VHF transmitters and receivers for the Signal Corps and Air Force.

In the field of lower frequency communications (for both commercial and military applications), the company has designed high-powered transmitters covering both the low-frequency communications and navigation band of 200 to 500 kilocycles and the high-frequency band of 2 to 20 megacycles.

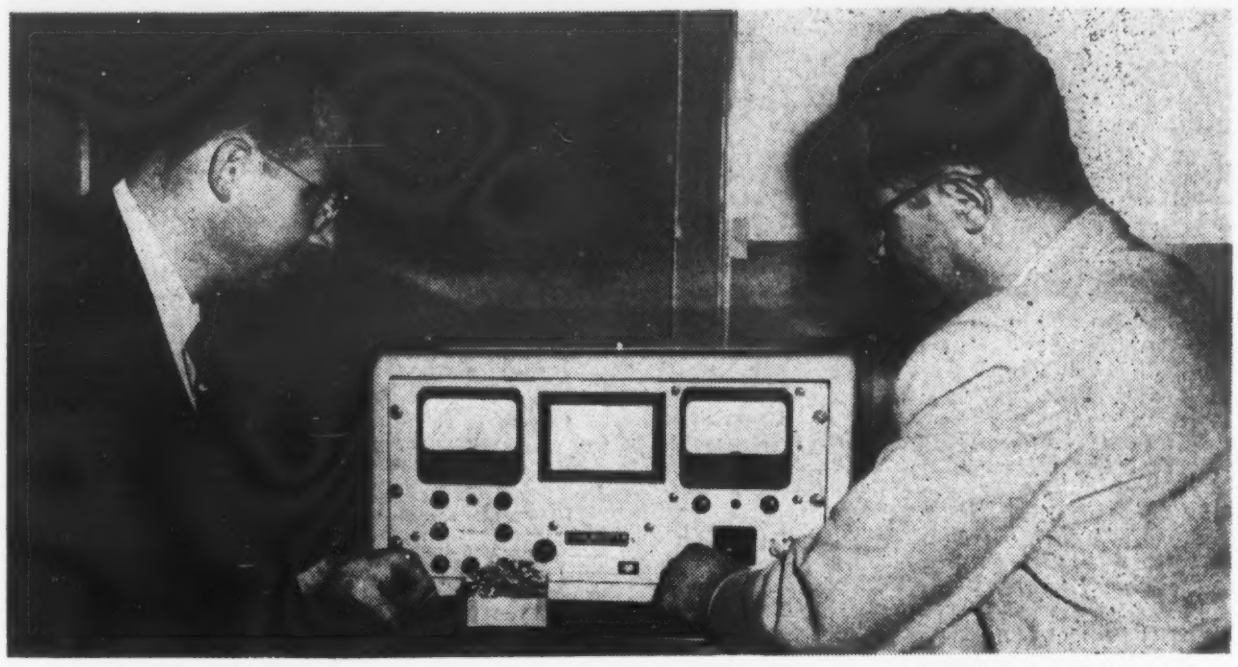
Development Program for the Services

Since early in World War II, the company has been one of the major contractors in the "Identification—Friend or Foe" (IFF) field. This activity has included the design and production of lightweight interrogator-responsors used by the Army and Air Force in World War II, and the design and production of many of the ground interrogator-responsors presently used by these Services.

In addition to the basic IFF equipment, the company has also developed and produced complete IFF systems including associated coding apparatus, directional and non-directional antenna systems, and the various control and interconnecting units required for custom installation with a particular primary radar system. Much of this equipment was produced for ground transportable applications, and the mechanical specifications were comparable in severity with those required for airborne equipment.

Radio Receptor has contributed to the development of crystal-controlled microwave transmitters for various navigational applications. Moreover, the company was the first to manufacture these units successfully on a production basis. The r-f plumbing for this equipment represented a substantial departure from previous techniques.

Extensive research programs have been conducted for the development of equipment utilizing complex video circuitry of all types. These have included special coding and decoding apparatus for multiple pulse trains.



New transistror noise meter being tried out by David DeWitt, vice president in charge of research, and Radio Receptor's chief engineer, Charles Hittner. The company has been one of the pioneers in transistor development.

Other development programs have included various projects in the field of electrical counter-measures such as airborne jamming transmitters, pulse analyzers, panoramic receivers and a subminiature direction finding receiver. In addition, recent activity has been directed toward the development of various radar beacons. This not only has involved designs by more conventional means, but also has entailed the use of the latest techniques in transistorization and subminiaturization. In connection with these programs, investigations have been made into the use of printed wiring and other subminiature techniques.

As a result of this valuable experience and continuous development and research activity on the part of the company's Engineering Products Division, plus the progress made by its Semi-Conductor Division in sturdy and efficient transistors for electronic computers and hearing aids, Radio Receptor recently announced an expansion program. It will meet the need for developing and manufacturing electronic components and complete systems for guided missiles and other weapons. A new building has been added to the company's two plants, now operating at full capacity, which provides 66,000 square feet of additional space. Eighty engineers have been assigned to the expanded program.

This new activity has been placed under the direction of the company's vice president, Vice Admiral J. J. "Jocko" Clark, USN (Ret.), a pioneer in naval aviation.

Thus, Radio Receptor's Engineering Products Division is continuing a policy begun many years ago when the company's current president and founder, Hugo Cohn, determined that its growth should be measured by its ability not only to develop and product-engineer the latest products and equipment in the field, but also to produce them. Product-engineering is regarded as a principal activity of the Engineering Department of the Engineering Products Division, and the highest engineering standards are maintained in all phases of the company's operations.

Plans for the Future

The Semi-Conductor Division makes germanium and silicon diodes and selenium rectifiers. The latter range from small cartridge sizes through radio, television, industrial power and magnetic amplifier types. Embedded and hermetically sealed units are available, as well as stacks for operation at 125° Centigrade.

According to Mr. Cohn, who originated his company's Thermatron Division where high-frequency heating machinery is produced, "This equipment has not only proven to be the most reliable and economical method of heat sealing thermo-plastics and plastisol curing, but has also proven extremely effective for electronic edge bonding and other large-scale wood operations."

With progressive management, the Radio Receptor Company has moved slowly but steadily forward in the industry's ranks. It has a 33-year record of outstanding experience and at the same time has amassed top engineering achievement and quality performance. With sales now in the $15,000,000 range, 1,200 veteran employees, and additional plant facilities, the road ahead looks exceedingly bright.

One Year Later at Fort Huachuca

Organization of the Army Electronic Proving Ground

by Major Walter White, Jr., SigC
Signal Plans & Operations Division
Office of the Chief Signal Officer

THE ARMY ELECTRONIC PROVING Ground is charged with providing the commander in the field with electronic devices and systems which will enhance his chances for success in battle. Located at Fort Huachuca, Arizona, the AEPG was established on February 1, 1954 by the Department of the Army and assigned to the Signal Corps.

In order to perform technical engineering tests and evaluations of communication and electronic systems and equipment, to conduct operational research, experiments and field tests, to formulate doctrines and techniques, and to provide specialized individual and unit training, the Proving Ground is divided into five operating departments. These departments are: Electronic Warfare, Engineering and Technical, Battlefield Surveillance, Aviation and Meteorological and Combat Development.

Each department has its own mission which is closely related to the mission of the other departments and is a portion of the overall program of the AEPG.

Electronic Warfare Tactics

The mission of the Electronic Warfare Department is three-fold. First, it is charged with the development of requirements, doctrines, operational techniques, organization and training criteria for electronic warfare systems and field operating organizations and for their appropriate employment. Secondly, this department must test, evaluate and develop operational and military characteristics of electronic warfare materials and systems. Thirdly, it must furnish technical guidance to overseas teams.

The tethered aerial lift device or captive helicopter, shown above, is currently undergoing operational tests at AEPG. Such tests include the feasibility and study of the device for use as an elevated platform, or for hoisting television cameras or small radar sets.

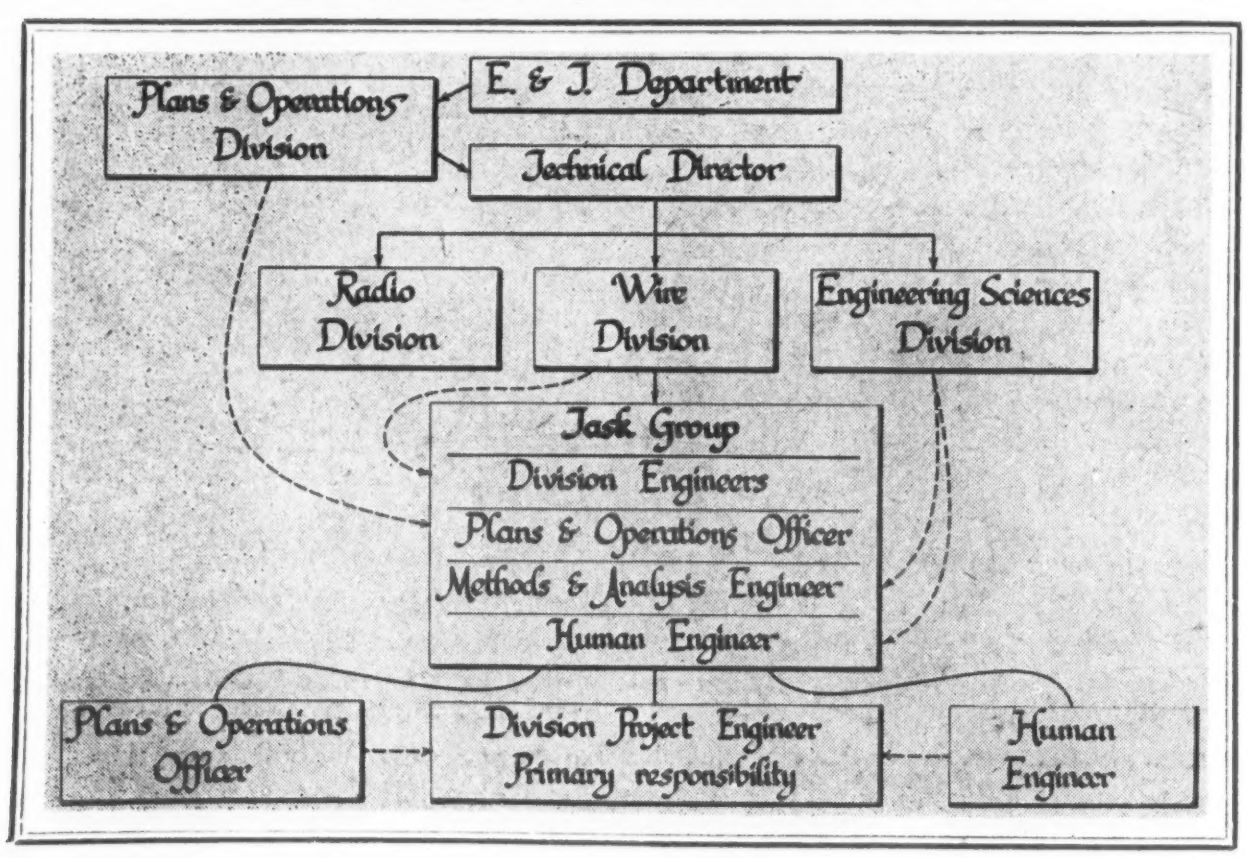
The details of the work of the Electronic Warfare Department are, for the most part, highly classified. Of particular interest is an experiment which is being conducted on the AN/GRC-26A radio set. The "vulnerability test" is performed by spacing two of these radio sets 20 miles apart and jamming them with a jamming transmitter which is located about 20 miles from the target receiver of this net.

The object of jamming is to prevent or delay the passage of information from one station to another. It is evident that electronic warfare techniques can do much to disrupt the communications of the enemy.

Detailed Procedures for Tests

The basic objective of the Engineering and Technical Department is to put operational and engineering field testing, evaluation and experimentation, as well as military effectiveness and feasibility studies, on a truly scientific basis. To accomplish

Below is the flow chart of activities on a typical project within the Engineering and Technical Department at the Army Electronic Proving Ground.



this mission, the Department's operations rely on employment of research techniques, detailed planning, engineering supervision of tests and troop operation of equipment.

The accompanying chart illustrates a typical "planned method of operation" for a wire communication project. Planning is accomplished by an ad hoc group established for each project. In this group, the project officer contributes his military knowledge to insure tactical validity of the test. The human engineer advises on the psychological aspects and perfects the human factors in the test plan. The methods and analysis consultant proposes methods and techniques of conducting tests and analysing data in the interest of efficiency.

After approval of the test plan, the project engineer maintains complete responsibility for the test, and the project officer continues to act as tactical adviser, with the human engineer supervising the human factor aspects of the test.

Technical Sensory Devices

In the past, battlefield surveillance was more familiarly known as "reconnaissance." Today, it includes all weather detection, location and identification of elements on the battlefield. This is achieved by extending the range of the human senses of sight, hearing and, even, smell by the employment of modern electronics and other technical devices. The Battlefield Surveillance System includes not only all the technical sensory devices, but also the handling, transmission and presentation of data developed by these devices.

Equipment, personnel and space are required to carry out this department's mission. Prior to the activation of the AEPG, the Chief Signal Officer did not have adequate space, personnel or facilities available to test all the elements of surveillance systems and to develop such systems to a point where they could be operationally tested on a Field Army scale.

This department is not self-sustaining. It depends on the other AEPG departments for support and coordination, and upon the general reserve units and other troops for much of the manpower required to conduct the field tests.

Aviation and Weather

The Chief Signal Officer, in order to meet his increasing responsibilities in the fields of aviation and meteorology and to provide a facility for the test and evaluation of aviation electronic equipment and systems, established the Signal Corps Army Aviation Center at Fort Monmouth on July 1, 1952. On July 1, 1954, SCAAC was moved to Fort Huachuca and became the Aviation and Meteorological Department of the AEPG.

Divided into two divisions, Aviation and Meteorological, each performs operational research in its specific field. The Meteorological Division provides operational meteorological support, where weather is a significant factor, to all Army research and development programs, such as those conducted at Yuma Test Station, Dugaway Proving Ground and Fort Monmouth.

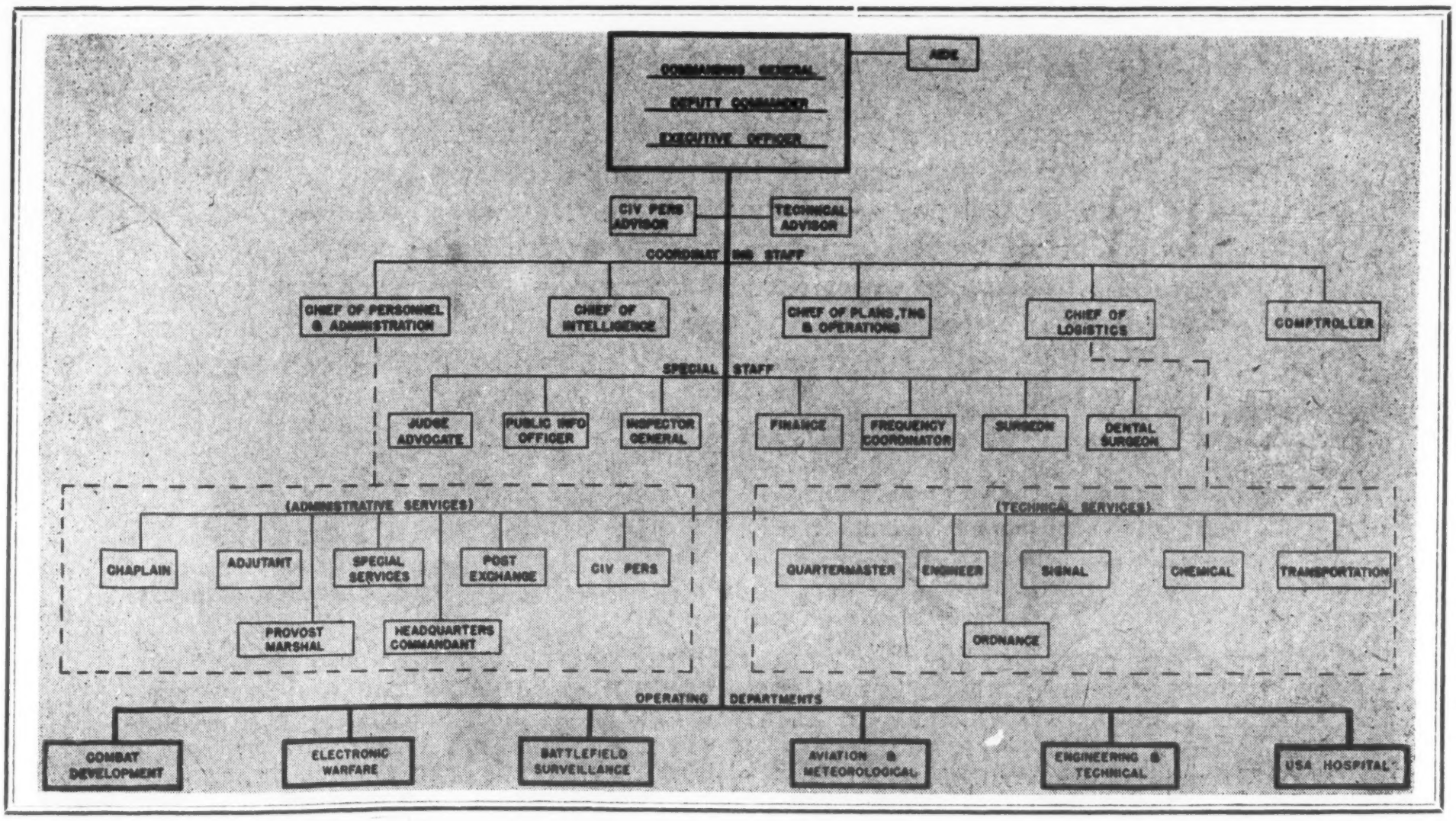
The Combat Development Department is the youngest member of the AEPG family. Its objective is to insure Signal Corps readiness to provide timely and reliable Signal support for modern armies.

The AEPG fulfills a need which has arisen as Signal communication and electronic system requirements increase in complexity and magnitude. It is to the Signal Corps what Aberdeen is to the Ordnance Corps. Here, for the first time, are gathered together the tools required by the Army establishment, under the direction of the Chief Signal Officer, to conduct operational research on electronic and signal systems required by the demands of modern and future warfare.

The author wishes to thank Major General Emil Lenzner and his staff at AEPG for the material furnished and assistance rendered in the preparation of this material.

(Ed. Note: See May-June 1954 issue of SIGNAL for feature article, entitled "From Cavalry to Communications," on the history of Fort Huachuca.)

Organization chart of the Army Electronic Proving Ground, Fort Huachuca, Arizona. The Proving Ground is divided into six major departments. The troops, consisting of general reserve units and special troops, are under the command of the Commanding General. A coordinating and special staff assists the Commanding General in the execution of his duties.



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SIGNAL's Photo Editor discusses

Progress in Photographic Engineering

- **Light Amplification**
- **Electrophotography**
- **Optics**
- **Underwater Photography**

by Frank Smith
Signal Corps Engineering Laboratories

I. Light Amplification

It appears that the age-old desire of scientists to amplify light—to obtain a multiplicity of photons— has been realized. Of the several systems of light amplification announced to date, let us first consider the General Electric Company's development (figure 1).

In this amplifier, developed by Dominic A. Cusano and Dr. Frank Studer, two G-E scientists, amplification of the light is direct and does not require the use of electronic tubes. It is based upon the phenomenon known as electroluminescence. The device consists essentially of a flat four-inch square glass screen with a layer of phosphor which produces light in the presence of an exciting radiation, in this case, ultraviolet light. The phosphor containing screen is sandwiched between two electrically conducting glass plates. When excited by suitable radiation, such as light from a projector, an image is produced on the phosphor screen. The amplifier makes the projected picture image ten times brighter.

The phosphors used are stated to be a combination of zinc sulfide and manganese. Tests performed on the amplifier indicate that each ultraviolet light unit or photon that impinges upon the phosphor results in the generation of ten photons of visible light, thus giving an amplification of 10. Mr. Cusano predicted that an output of 500 photons for each photon received by the amplifier was not beyond ultimate reach.

Referring to the light amplifier under development by the Radio Corporation of America, Brig. Gen. David Sarnoff has announced that his company is very much in the race to produce a useful instrument. As announced in the press, the RCA light amplifier, developed under the direction of Ed Herold, is composed of a light-sensitive material and a layer of material that glows when a current of electricity is passed through it. A projected light or image striking the light-sensitive layer causes the other layer to emit its own light.

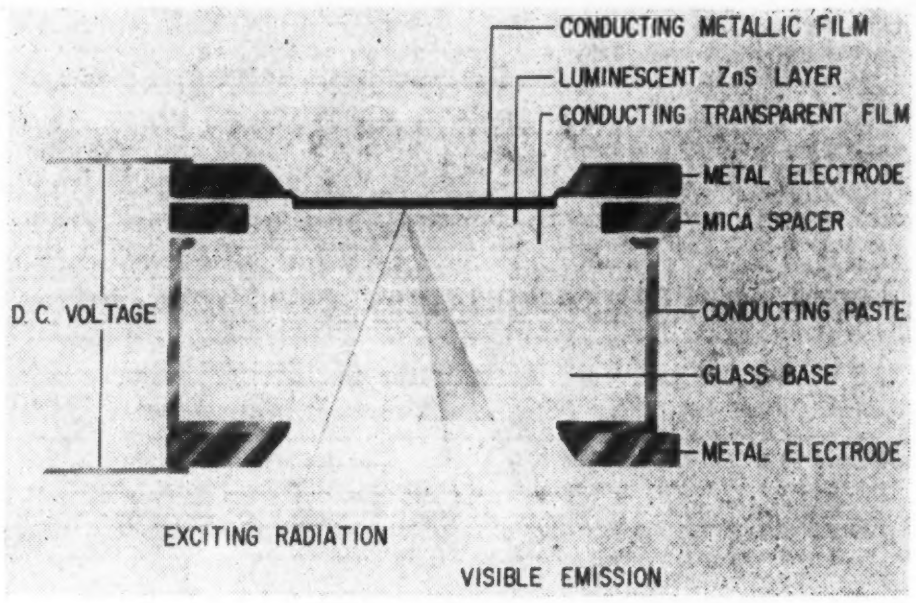

Figure 1. The above schematic diagram shows the elements of the special phosphor developed at the General Electric Research Laboratory to achieve direct amplification of light, without the use of electronic tubes.

In operation, a barely visible still picture is projected against the back of the device, which is about a foot square. The amplified image then appears on the front of the screen. The device is a sandwich of two materials, the back material being a compound whose electrical properties change when light is projected onto it. The front is a light-emitting material whose luminescence changes when its electrical properties are altered. So far, amplification of more than twenty times has been attained. This brightness increase is sufficient for practical use in brightening dim images in x-ray fluoroscopy, radar and television.

In addition, the amplifier produces "cold light" in contrast to the light produced by conventional incandes-

This article is adapted from a paper presented by the author at a Spring meeting of the Monmouth Chapter, Society of Photographic Engineers.

cent bulbs as the result of heat. It is reported that further changes when its electrical properties are altered So far, development is expected to achieve a substantially greater amplification as well as produce images in more than one color.

Besides G-E and RCA, the Farnsworth Electronics Company is reported to have produced a light amplifier which utilizes ordinary light rather than x-rays. This unit, using an electroluminescent phosphor and photoconductor material sandwiched between two glass plates, is stated to be capable of producing an amplification of 24.

Another interesting development concerns an astronomical camera which utilizes electronic amplification. This device, developed in France, is a result of work done by Drs. Andre Lallemand and Maurice Duchesne of the Paris Observatory. Principle of operation of the camera is that light coming from a distant astronomical subject, such as a star, strikes a thin plate of glass covered on one side by a fine layer of caesium and antimony. The impact frees electrons which fall on the same trajectory the light would have followed. An electronic "optical" system accelerates these electrons before they strike the photographic plate and imparts to them energy far greater than the photons originally possessed.

The new camera, which is reported to amplify thousands of times, is expected to cut down to about four minutes the exposure time for astronomical subjects now requiring exposure times sometimes as long as eight hours. Because of these long exposure times, the conventional photographic methods have about reached their limits in astronomical photography.

Patents on Amplifiers Go Back to 1951

In connection with light amplification and image intensifying systems in general, and particularly those of RCA and G-E, a study suggests that all these systems depend basically upon a phosphor excited by an electrical field, thereby giving off light. With this in mind, it might be of interest to students of the subject to refer to U. S. Patent No. 2,566,340 dated September 5, 1951, entitled "Electroluminescent Lamp," issued to E. L. Mager and assigned to Sylvania Electric Products Company. This patent, one of the first if not the first in the field, covers an electroluminescent lamp from which light is obtained by direct application of voltage across a phosphor or by placing the phosphor in an electric field.

Another early patent, U. S. Patent No. 2,594,740 dated April 29, 1952, entitled "Electronic Light Amplifier," was issued to Dr. Lee de Forest and William A. Rhodes. This patent covers a light amplifier that transforms a beam of light into a beam of electrons duplicating the original image, and increases the intensity of the electron beam to obtain an amplified electron beam still maintaining the original image, and which transforms the amplified electron beam into an amplified light beam duplicating the original image with increased intensity or brightness. The amplification factor of the amplifier (with three stages of amplification) is of the order of 125. In addition to possible TV applications, the amplifier may be employed in a motion picture projection system or in x-ray fluoroscopy.

An interesting method of obtaining increased brightness by electroluminescence is disclosed in U. S. Patent No. 2,650,310 dated August 25, 1953, entitled "X-Ray Image Intensification and Method," issued to William C. White and assigned to the General Electric Company, Schenectady, New York. White's patent covers a method and means for producing x-ray images of greater luminosity than is possible by fluorescence of phosphors, while at the same time, it keeps down the x-ray intensity to a level that is not dangerous to those exposed to x-ray radiation. In accordance with the invention, visual images corresponding to an invisible x-ray pattern are produced by an electroluminescent material through the intermediary effect of a medium, the electrical impedance of which is subject to variations by the passage of x-rays through it.

Arthuber and Ullery, writing in the *Journal of the Optical Society of America* for April, 1954, describe a solid-state image intensifier which avoids evacuated envelopes and utilizes a sandwiched layer of photoconductor and electroluminescent phosphor. Basis of this intensifier is the exclusive application of solid-state components which do not require evacuated envelopes as do other methods. Such an intensifier has the appearance of a flat screen and is therefore especially adaptable to the intensification of large images such as projected TV pictures or fluoroscopic images. The authors state that a working model of the intensifier was able to intensify images by a factor of two. Study of this paper and the aforementioned patent by White strongly indicates that General Electric uses this method or a variation thereof on its light amplifier.

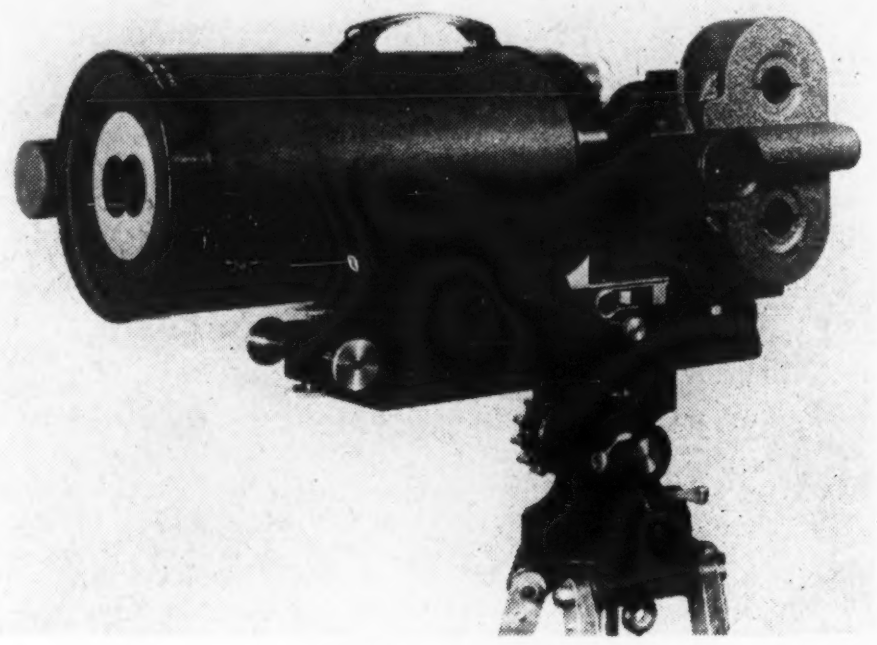

Figure 2. This mirror-type telephoto lens for long range work was developed by the Zoomar Corp. The barrel of the "Reflectar" is made of a special thermosetting plastic that is claimed to have practically the same coefficient of expansion as the optical glass used in the optical system, causing optical changes that might be affected by temperature variations to cancel out. (See "III. Optics", page 35).

II. Electrostatic Electrophotography and Analogous Processes

One development that appears to have made considerable progress recently is that of electrostatic electrophotography and analogous processes. Of these, the Electrofax Dry Photo Process of RCA seems to be the most significant at this time.

This process consists of a simplified direct printing electrophotographic paper having sensitivity to light sufficient for projection printing and enlargements. No chemical processing is required.

The paper is made by applying to it a thin layer of a special zinc oxide in a resin binder. In this condition, the paper is insensitive to light and may be handled without fear of exposure until it is given a negative electrostatic charge.

(*Continued on page* 34)

CELESTIAL SECRETS

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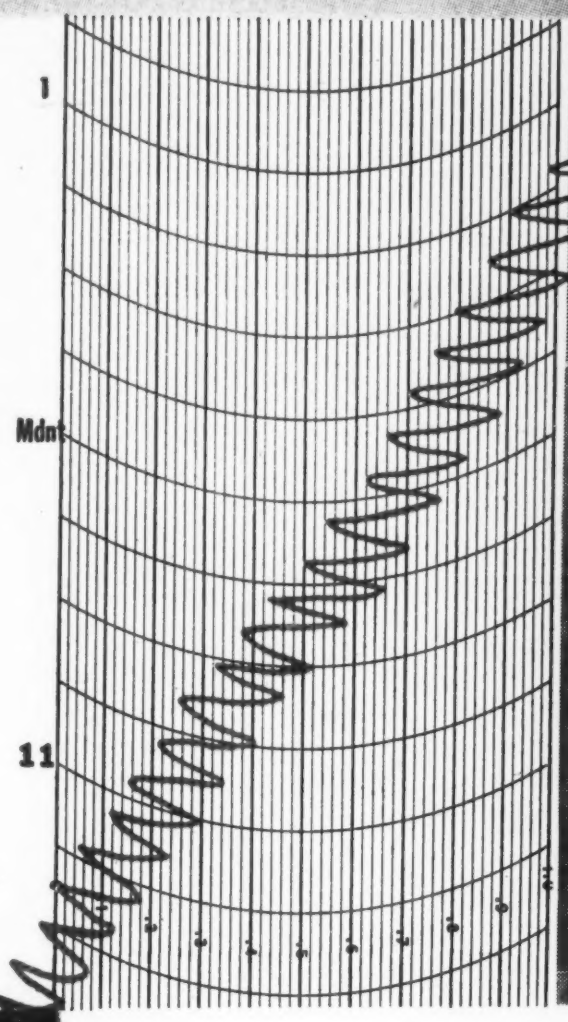
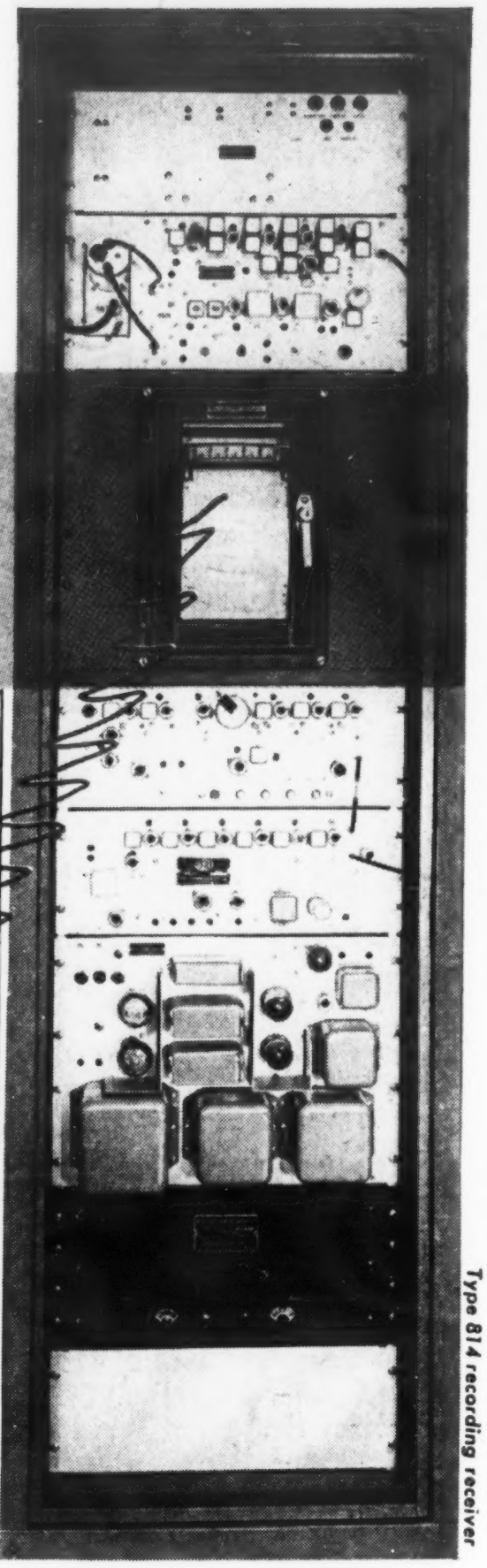
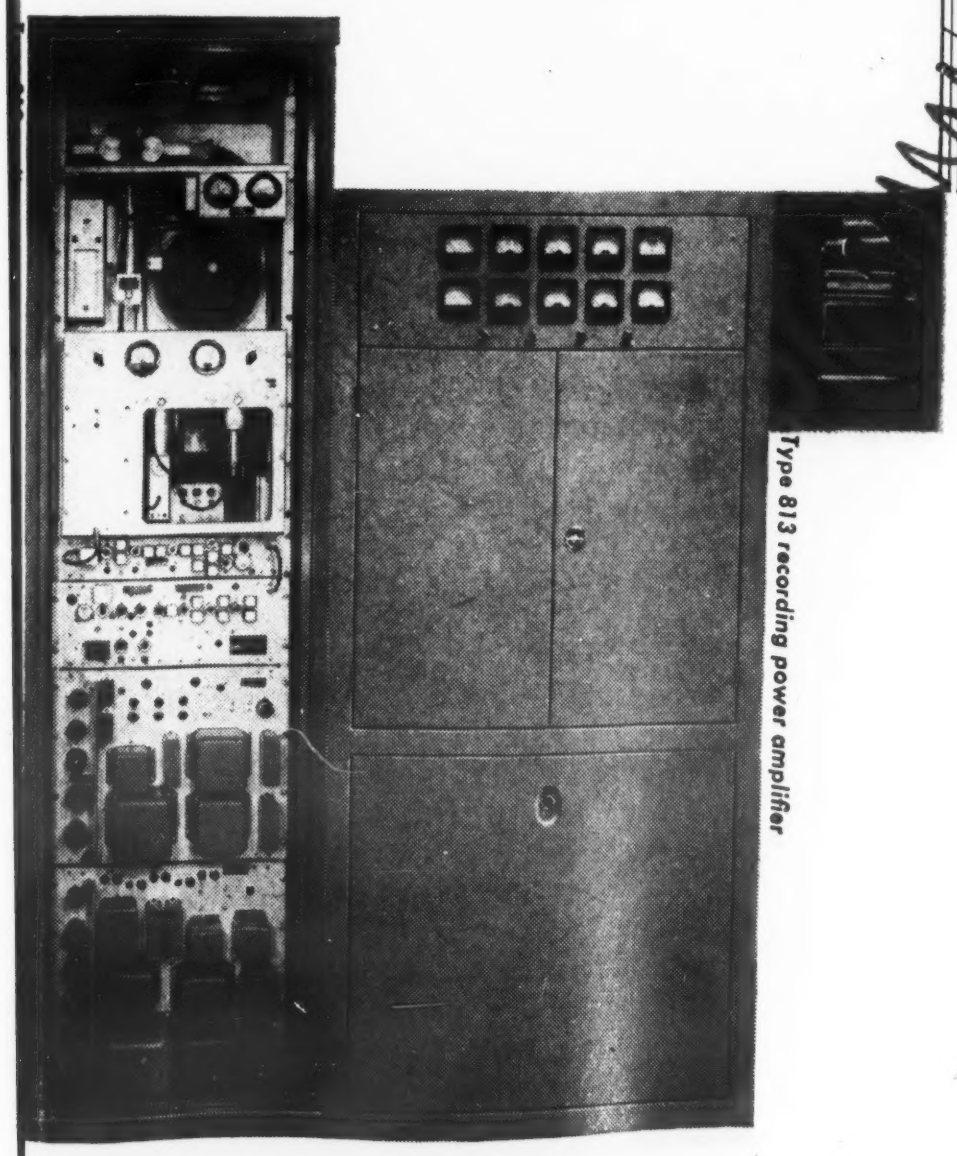




Type 814 recording receiver



Type 813 recording power amplifier

The charge is applied in total darkness by means of a charged wire drawn across it. This action renders the paper sensitive to light, and it may be exposed by any of the conventional photographic methods. It is reported that the paper has also been exposed in a camera, with exposures of ½ second in bright sunlight to produce a useful print.

Development of the latent image is accomplished by applying a pigmented resin powder carrying a positive electrostatic charge which causes the powder to adhere to the negatively charged areas on the paper. The image, which has now been rendered visible, may be fixed permanently by baking the sheet for a few seconds at a temperature that will fuse the resin particles.

Spectral response of the Electrofax paper is in the near ultraviolet range and can be extended into the visible range by sensitization with organic dyes. Chief advantage of this process is that it does away with the plates used in other systems, as the paper on which the image is developed is the final print. A finished copy of a print is produced in a fraction of a minute.

Smoke-Printer Uses Ordinary Paper

Another interesting recent development using an analogous method of electrostatic electrophotography is the "Photronic Reproducer" or smoke-printer of the Standard Register Co., Dayton, Ohio. In this process, a picture image from a positive or negative film is projected onto a metal-backed glass to make an invisible pattern of electrical charges. Plain paper is placed in front of the metallic coated glass. Smoke vapor consisting of vaporized ink passes through an electric grid which gives it a charge, and the charges on the metal-backed glass attract the electrified smoke so that it settles on the paper in the pattern of the projected picture.

Reports indicate that the process can handle the same kind of jobs as a photostat or mimeograph and that it possesses several advantages over these methods. First, the process is exceedingly fast; it can make sixty 8½ x 11 inch prints in one minute. Secondly, it is cheaper than processes that require photo-sensitized paper, and it is versatile since it can print from either a negative or positive. The process is based on the patents of William C. Huebner, the latest one of which appears to be U. S. No. 2,676,100 dated April 20, 1954, entitled "Method and Apparatus for Reproducing Images."

While on the subject of electrostatic electrophotography, it may be worth while noting U. S. Patent No. 2,693,416 dated November 2, 1954, entitled "Method of Electrostatic Electrophotography" issued to L. B. Butterfield. Butterfield's method covers a simplified method of electrostatic printing wherein the steps necessary to carry out the process are reduced.

Briefly, Butterfield's object is to provide a method for projecting a light image through a transparent or translucent sheet of material to form an electrostatic image on a photoconductive surface. In one embodiment of Butterfield's method, a film having an image to be reproduced is placed in front of a light source. The image on the film is projected by a beam of light through an electrostatically charged transparent or translucent sheet of material onto a photoconductive layer, whereupon the portions of the photoconductive layer subjected to the light are rendered conductive. Charges of opposite polarity to those on the transparent or translucent material now migrate, by attraction, through the lighted portions of the photoconductive layer to the underside of the transparent or translucent sheet of material to form electric couples which have negligible external fields. Thus the charges on the

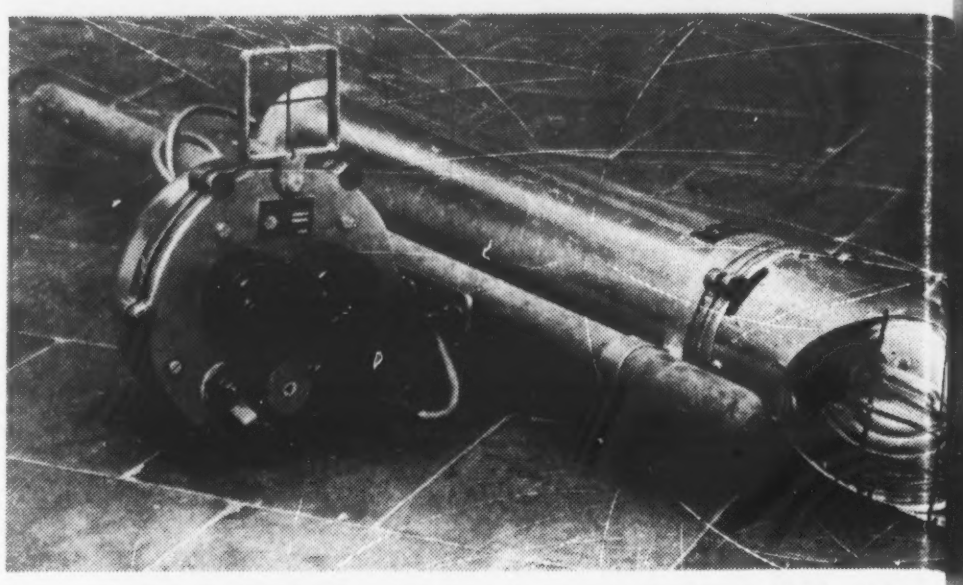


Figure 3. The Rebikoff "Torpedo" underwater electronic flash unit is available for continuouse lighting as well as flash lighting. (See "IV. Underwater Photography," page 46).

portions of the transparent or translucent sheet of material, not subjected to the light, remain with an effective external field. The transparent or translucent sheet of material is then sprinkled with an electrostatically attractable powder to form a visible image of the electrostatic image. The sheet of material is removed from contact with the photoconductive surface and, finally, the powder is fixed by any suitable process to the sheet of material to form a permanent visible image.

Butterfield claims that any one of a variety of photoconductive materials may be used for the photoconductive layer, such as amorphous selenium, sulphur, germanium, lead sulphide, copper oxide, silver chloride, silver iodide and various combinations of selenium and sulphur.

It will be thus seen that Butterfield's process differs from conventional electrostatic electrophotography in that the image formed on the photoconductive surface is not developed by powder and then lifted, but rather that the image is formed on transparent or translucent material and then developed and fixed. In this respect, the process may be said to be somewhat analogous to the Photronic Reproducer system of Standard Register which forms an image on paper by means of vaporized ink smoke rather than powder particles.

An interesting combination of the phenomena of electrostatic electrophotography and electroluminescence is noted in a recent paper, by F. A. Schwartz, M. N. Haller and J. J. Mazenko in the *Journal of the Optical Society of America* for September, 1954, which described luminescent photographs. These phenomena have been combined in a way which permits the production of self-luminous photographs. Briefly, the distribution intensity of a layer of electroluminescent phosphor powder is controlled by the xerographic technique, and the powder is caused to luminesce by subjecting it to the action of an alternating electric field.

The self-luminous photographs are prepared by first dip-coating a clear sheet of NESA glass with a clear thermoplastic resin. The phosphor powder pattern is then formed on a selenium plate by ordinary xerographic procedures, the distribution-in-surface density of the powder being controlled with the aid of a screened positive photo-transparency of the halftone subject. The plastic coated NESA glass is placed, conducting face down, on the selenium plate and the phosphor pattern is transferred to the plastic coating by means of electrostatic forces which are produced by corona charging the face-up side of the glass sheet. The phosphor powder is then "fixed" by bringing the plastic coating up to its softening point and holding it there for several minutes. Finally, an aluminum electrode is vacuum-evaporated over the phos-

phor layer. The halftone is made to luminesce by applying an alternating voltage between the transparent conductive layer and the aluminum electrode.

One of the recent and useful applications of the xerographic process is in the field of radiography. Called "Xeroradiography," the process offers a simple, safe and inexpensive medium for recording x-ray images. Since the process is entirely dry, no solutions or liquids of any kind are necessary. Likewise, no darkrooms nor lead-lined storage vaults are required since radiation has no harmful effect on the xerographic equipment. Thus there is no film deterioration problem and no transport of large supplies is involved, because the xerographic plates of the process can be used over and over again. Since speed of operation is usually a factor in most applications, it is possible to have a xerographic plate ready for interpretation within one minute of the time the x-ray exposure is completed. Using light in the visible wave lengths, as many as 56 lines per mm have been clearly recorded on the plates. The story of the process and its use in the recording of x-ray images is told in a paper entitled "Xeroradiography," by Drs. Faunce Roach and Herman E. Hilleboe in the *American Journal of Roentgenology* for January, 1955.

Liquid Developer for Xerographic Plates

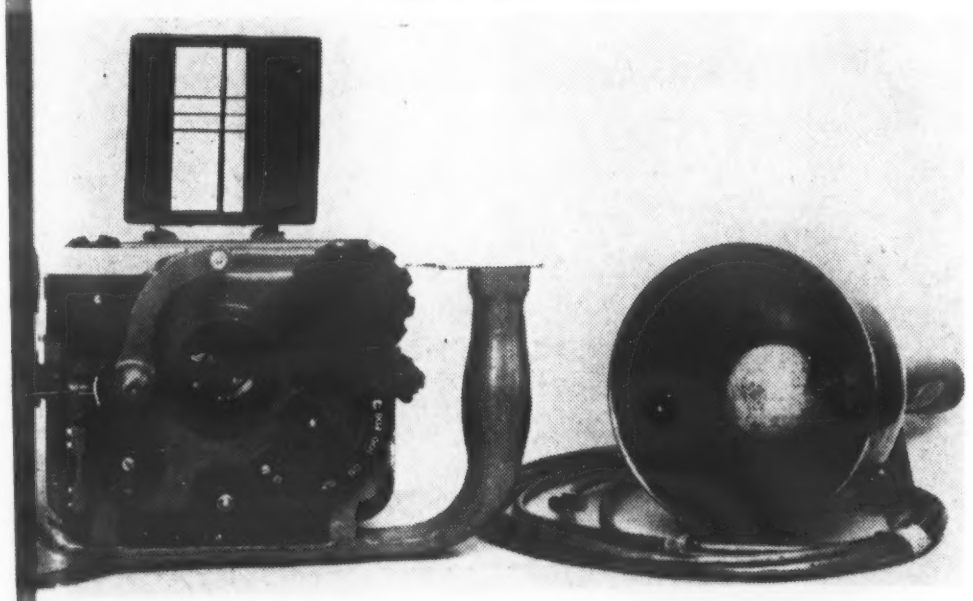
The conventional method of "developing" xerographic images has been a dry one, in that a powder or vaporized substance such as ink is sprayed or dusted onto the surface of the plate containing the latent image. Recently, K. A. Metcalfe of England, in the course of some work with selenium coated xerographic plates, found that a "developer" based on liquid dispersion media offered better control and shorter development times than the dry methods. The liquids investigated included petrol, kerosene, turpentine, benzol and carbon tetrachloride. Several powders, including certain talcum powders, magnesium oxide, carbon black and a number of pigments, disperse freely in these liquids and in so doing, acquire a charge, which is characteristic of the powder.

In Metcalfe's method, the plates may be "developed" in either tanks, trays or dishes; the developing time ranging from one to ten seconds according to the particular developer used, and the developed images are ready for examination immediately after development. Advantages claimed for the liquid development are greater simplicity and speed of operation coupled with improved control and versatility.

Before closing the subject of electrophotography, it might be appropriate to discuss briefly the work of C. F. Carlson on an electrophotographic camera.

Carlson's invention covers improvements to the electrophotographic process including means for producing a liquid mist, spray or fog for developing the image. The combination with an electrostatic image plate of an auxiliary electrode to control development is also a feature. The camera produces a complete finished print, and by applying a negative or positive charge to the developing mist or spray, a negative or positive reproduction can be made.

Figure 4. The Fenjohn "Goggler" underwater still camera uses 120 or 70mm film.



III. Optics

One line of development that has been proceeding at a fast pace during the past two to three years is in the field of variable focal length or "zoom" lenses for television and motion picture use.

Of these, perhaps the best known in the United States is the "Zoomar" 16mm variable focus lens and associated viewfinder manufactured by the Zoomar Corp. of Glen Cove, N. Y., for attachment to any 16mm camera without alteration to camera or lens. This lens is said to possess many new features. It is a single, medium-speed lens that provides "zoom" effects from standard to telephoto (from 1 inch to 3 inches) and is simple to operate.

In operation, a smooth lever motion produces the desired focal length. The lens is a siamese-twin unit, the viewfinder and taking lens being connected to each other and inseparable, thus the coupled viewfinder moves with the lens at all times. Aperture range of the lens is f/2.8 to f/16 and the distance range is 8 feet to infinity, short range adapters being available for shorter distances.

Another interesting development in the field of varifocal lenses is the "Varotal" lens developed by Taylor, Taylor & Hobson of Great Britain. This lens is specifically designed for use with TV cameras and accordingly covers a picture size of 1¼" x 1". At any focal length within its range, its performance is said to be equal to a fixed focus camera lens of normal construction. The "Varotal" gives a range of magnifications of 5 to 1 and the design is such that with it, by interchange of the rear component, two ranges of focal length can be obtained, 5 to 25 inches and 8 to 40 inches.

The lens is composed of four doublets and one single component and has 10 glass/air surfaces. The maximum aperture, which is constant throughout the range of focal lengths, is f/5.6 for the shorter range of focal lengths and f/8 for the longer range. The lens can be obtained either in hand-operated or electrically operated models. Despite the fact that it is designed for television cameras, there appears to be no reason why it cannot be used for motion picture work although, in this case, it would give a slightly smaller angular field.

Recent press reports indicate that the Perkin-Elmer Corp. of Norwalk, Conn., has acquired the patent rights to this lens and will manufacture it in the United States. The Perkin-Elmer Corp. has scaled down the lens and designed a motor drive as an integral part of it. This makes it less cumbersome for use as a 16mm motion picture lens.

Another line of development in the field of optics is that of mirror type telephoto lenses for long range work in photographic instrumentation, television and motion pictures, by the Zoomar Corp.

Designated the "Reflectar" (figure 2), the lenses are made in focal lengths of 40, 80 and 100-inch and are said to possess the following advantages: high resolving power; high brilliancy; thermal stability; full color correction; minimum weight and length; mechanical ruggedness and adaptability to all cameras.

A unique feature of the "Reflectar" lenses is the barrel which is made of a special thermosetting plastic

(*Continued on page 46, col. 1*)

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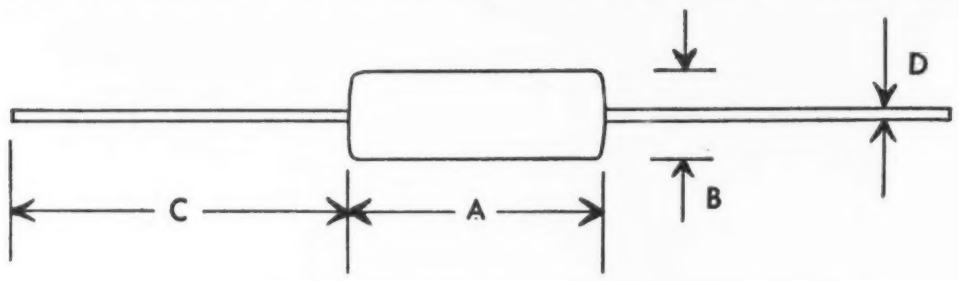
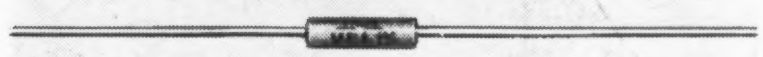
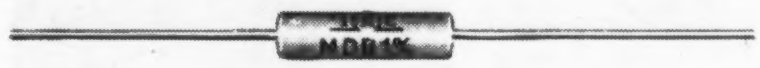


Precistor Types	IRC Size Equivalent	Dimension			
		A	B	C	D
MDA — MBA	BTS	13/32"	1/8"	1½"	.025"
MDB — MBB	BW½	5/8"	3/16"	1½"	.025"
MDC — MBC	BTA	23/32"	1/4"	1½"	.032"

MOLDED DEPOSITED CARBON PRECISTORS



Type MDA — 1/8 Watt



Type MDB — 1/4 Watt

Type MDC — ½ Watt

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Type MBB — 1/4 Watt

Type MBC — ½ Watt

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The Role of MANAGEMENT in Industrial Defense

by Donald S. Parris

Acting Director, Electronics Division
Business and Defense Services Administration
U. S. Department of Commerce

"If we should fail to take certain actions discussed by BDSA, in view of the stated danger of attack we might find ourselves subject to stockholders' suits for negligence in the conduct of the affairs of the corporation." Thus remarked the general counsel of an important producer of military products during a conference with BDSA on industrial defense.

The program being reviewed was that developed by the Business and Defense Services Administration of the U.S. Department of Commerce with the assistance of a special task force from American industry, in accordance with a directive from the Office of Defense Mobilization. This program represents a coordinated industry-Government approach to what is called industrial defense—the steps which can be taken by industrial management to minimize the impact of a direct enemy attack on our American industrial complex.

It is significant to note at this point that a number of companies have found that many of the actions called for by an industrial defense program have turned out to be a good business practice for current operations. We are told that they will be continued even if the threat of war should materially lessen, since they are good insurance against disruption to production resulting from natural disaster. Some companies show a profit in reduction of insurance premiums and other costs of operation.

Program for Security Outlined

The BDSA program for the electronics industry was first presented at a meeting in Chicago June 16, 1953, held with the cooperation of the Radio-Electronics-Television Manufacturers Association. At that meeting the National Production Authority Electronics Division, NPA specialists in Industrial Defense, and an engineer from the Federal Civil Defense Administration defined the key objectives of the program as follows:

1. To limit the number of prime industrial targets by undertaking dispersion to the extent feasible;
2. To minimize the potential damage to targets by such means as protective construction, civil defense preparations, and safeguards against sabotage;
3. Advance planning by company management to insure the earliest possible resumption of essential production after an attack or natural disaster.

The firms represented were asked to assign to one or more top company officials the responsibility for industrial defense planning. Since that time, many conferences with individual company managements have been held, both at the request of the companies and by invitation from BDSA. Since limitations of time necessarily make this type of coverage a slow process, an expansion of the program to the field offices of Department of Commerce is being considered.

You may ask, "Why should the producers of electronic and communication products spend time and effort on industrial defense?" The ever-increasing importance of the electronics and communications industries to the defense of our country makes your responsibility for the continuity of defense production greater than ever before.

In the last two wars we have won largely because of the industrial might of our country. Today, with the development by potential enemies of nuclear weapons and the means of using them on industrial targets in the United States, a new responsibility is placed on industrial management. No longer can a firm be depended upon for support of the defense effort during mobilization simply because of a demonstrated ability to design and produce military products in peace-time. Each company should develop its own industrial defense plan, tailored to its own specialized needs and capabilities.

Because of the broad scope of the planning necessary, industrial defense activities cannot be assigned to the company or plant security officer and then forgotten by the board of directors, the production manager, the chief engineer, the purchasing agent or other members of the production team. Every department of the company must do its part to achieve the goal of adequate industrial defense preparations.

The president of the company should appoint a person who will study the material which has been developed by other firms and by Government and coordinate the contributions from all officials of the company. Preferably

the plans should be reduced to writing so that each can see how his operations fit into the pattern. Once developed, the plan should be kept up-to-date and reviewed to insure that actions taken will continue to implement the longer term objectives.

It is not feasible to propose that all U. S. industry rapidly disperse to new locations. However, in the development of expansion plans, very serious consideration should be given to the desirability of choosing new sites at dispersed locations. This is especially important if the present production of military products is in critical target areas. The advantages of such a policy were ably presented in the article which appeared in the May-June 1955 issue of SIGNAL, "Dispersal is More than Defense Against Disaster," by Oliver J. Greenway, Vice President, International Resistance Company and WOC Consultant to the Electronics Division, BDSA. (*Reprints are available from U. S. Dept. of Commerce Field Offices or from Electronics Div., BDSA, Washington 25, D. C.*)

Assistance in connection with the selection and approval of a site from the standpoint of compliance with dispersal criteria is available through the Communications Equipment Division or the Electronics Division. Available to these divisions and to individual firms is the expert council of BDSA's Area Development Division, which gives technical assistance to local area dispersion committees throughout the United States, Government agencies, and individual manufacturers in surveys to determine conformance of proposed sites to the national industrial dispersion standards. Many large communities have formed committees which have made surveys to determine the existence and extent of potential target zones and to identify dispersed industrial sites in the area. The Area Development Division also performs a liaison function with the Department of Defense to avoid location of new facilities near existing or prospective major military installations or key industrial facilities.

Assistance in the form of accelerated tax amortization is available to firms which qualify on the basis of providing needed expansion of facilities for the production of electronic products for defense. To secure a TA certificate it is necessary to file the application before starting construction or securing delivery of the facilities. Counsel on TA applications is available from BDSA.

Provision for executive succession in the event of casualties is an important aspect in the planning for continuity of management. Some of the points to be considered in this connection include the following: *Do the present by-laws enable surviving directors and officers to take official action in an emergency situation?* Some states have made provision for legalizing actions by fewer than a normal quorum, provided this is arranged for in advance. *Has provision been made for the succession of key executive, technical, and administrative personnel?* Such succession lists need not be publicized but they should be made and stored in a safe place for use under emergency conditions.

Ingenuity in Procurement Methods

Purchasing policies are given serious attention in any well-organized industrial defense program. If you depend on a single distant source of supply for a key material or component used in the production of military products, all other continuity of production plans may be fruitless. Several electronics firms have undertaken extensive research programs for the development of alternate materials to free them from dependence on single sources of supply for critical bottleneck materials. At least one large military electronics producer has made an extensive list of the names and addresses of all his suppliers and potential suppliers, and provided safe storage for these lists in a remote safe location. This will enable surviving employees to re-establish supply lines for needed materials, even if the purchasing experts are lost to the operation.

Safe storage of company records, processes, drawings, specifications and even engineering note books at a remote location has been a feature of the programs of a number of electronics firms. Admittedly, the cost of duplication of records can be prohibitive if everything is copied, but the application of carefully developed criteria for the selection of material for processing will prevent waste of money and effort in this area.

Physical security consists of measures which will prevent or reduce damage to facilities, materials and personnel resulting from the effects of weapons, including nuclear weapons and acts of sabotage and subversion. It embodies such elements as:

1. Protective construction, including structural strengthening of buildings, installation of fire resistant materials, compartmentation, shelters for personnel, machinery and equipment and in some instances underground construction.
2. Protection of plant services, such as heating, plumbing, water, gas, power, telephone and other communications.
3. Stockpiling of spare equipment, tools, jigs, dies and materials for repair and replacement purposes in safe storage.
4. Provision for fire-fighting apparatus and other standby emergency equipment and damage control centers, and installation of communications, alarms, and protective lighting systems.
5. Measures commonly referred to as "industrial security," including control of access to plants, establishment of restricted areas within plants, procedures for handling classified material, and personnel security programs.

If the headquarters of a multi-plant company are located in an industrially congested area or likely target zone, management should select an alternate headquarters located in a safer area, to which key management and a nucleus of operating personnel could proceed in the event of an emergency. The alternate headquarters should be selected from a standpoint of security, accessibility, communications and accommodations. It should be equipped with the information and records necessary for the continuity of operations.

(*Continued on page 46, col. 2*)

Handbooks for Reference

Job for Management. **Business and Defense Services Administration, U. S. Department of Commerce, Washington 25, D. C. (1955).**

Industry Guide to Planning for Restoration of Production. **U. S. Department of Defense, Washington 25, D. C. (1954).**

Industrial Defense Planning Manual — Iron and Steel. **American Iron and Steel Institute, 350 Fifth Avenue, New York. (Price, $.50).**

Disaster Planning for the Oil and Gas Industries. **National Petroleum Council, 1625 K Street, N. W., Washington 6, D. C. (Price, $1.25).**

Industrial Dispersion Guidebook for Communities. **U. S. Department of Commerce, Washington 25, D. C. ($.30).**

Proceedings of Businessmen's Conference on Industrial Defense in the Atomic Age (1954). **Manufacture Department, Chamber of Commerce of the United States, Washington, D. C. (Price, $.50).**

USAF Communications—Electronics in the . . .

. . . Air Materiel Command, page 40

. . . Air Research and Development Command, page 43

. . . AMC

by Colonel Arthur L. Cox, USAF
Headquarters, Air Materiel Command
Wright-Patterson Air Force Base

THE MISSION OF THE AIR MATERIEL Command is to provide adequate, efficient, and up-to-date systems of procurement, maintenance and supply for the USAF on a world-wide basis.

To accomplish this mission, it is mandatory that a logistical system be designed which will allow for the reduction of inventories and at the same time provide adequate and timely logistic support for our combat forces in peace and war. Systems of high speed information flow and material flow are of fundamental importance, since they are utilized for the rapid logistic control which is necessary to shrink the time required for a supply cycle.

To conserve our resources and stay within our budgetary limits, ways and means are being developed to reduce stockpiling and pipeline time without reducing our combat effectiveness. To accomplish this, AMC is streamlining its supply, procurement, maintenance and transportation systems. Communications play a most vital role in the development, operation and control of these systems. AMC has conducted many service tests as a measure by which its communications requirement may be geared to meet this streamline feature logistical support. The results of these tests, separated in their various categories, are given in the remainder of this article.

Local Delivery of Messages

The local delivery of messages transmitted by electrical means is a problem within the Air Force. This problem is similar in scope to that of a commercial company in the receipt and delivery of messages in an average size city.

In recent years, several studies and experiments have been made in order to improve the overall speed of service between the writer and reader of a message. Some improvements have been made. Recent tabulations indicate that the major problem is between the communications centers and the originator or addressee. A large volume of messages is being "dumped" into the communications system at the end of each day. This "dumping" of messages is a serious problem, in that messages originating the previous day are not delivered to the ultimate addressee until around noon the following day.

The most economical method of solving this problem appears to be the use of facsimile equipment. Approval was obtained from Headquarters USAF to set up a sample installation at this Headquarters for the purpose of determining the feasibility of the use of facsimile equipment for this purpose and also its application of the principle to other Air Force activities.

The service test equipment was obtained in June and tested between the communications center and two divisions within the Headquarters.

The trial was very successful. It was found that outgoing messages prepared in the Operations and Serv-

This second group of articles continues our series on communications and electronics in the Air Force. Future articles will include reports from the Air Proving Ground Command, the Air Training Command and the Air University.

ices Division began appearing in the communications center for transmission as early as 0830 through the use of facsimile. On the other hand, outgoing messages delivered via the normal (runner) method did not arrive at the communications center until 1130 hours.

The use of facsimile equipment to accomplish local delivery service will permit the communications center to pool their equipment and personnel resources to provide accurate and expeditious handling of messages. It is also anticipated that a savings may be realized through substantial reduction in the use of long distance telephone service if a more satisfactory speed of service in the handling of messages can be assured.

IBM Data Transceivers

At the present time, an IBM data transceiver network is being installed connecting the 3101st Logistical Control Group (ATL) at Newark, New Jersey with the eastern zone supply depots. Later, a similar network will be installed, interconnecting the logistical control groups for relaying information.

The method employed is a direct card-to-card transmission. Overseas requisitions received at the control groups will be extracted to the appropriate zonal supply depot over the IBM data transceiver network. In the event it is necessary to re-transmit the requisition to another or opposite zonal supply depot, the retransmission is processed through the logistic control group. Thus, accurate information is available at all times on the status of any item being requisitioned.

The equipment uses the same code for transmission over either telegraph or telephone circuits. However, the speed of transmission is dependent on the class or type of circuit available.

Colonel Cox is the Chief, Communications—Electronics Branch, Operations and Services Division, Hq AMC. He enlisted in the Army Air Corps in January, 1929 and served at Luke Field, Hawaii and at March Field until he received a direct commission in April, 1942. He was then assigned as communications officer of the "Halverson Task Force". He served as an advisor to the Nationalist Chinese Air Force from '46 until '48. Before coming to the Air Materiel Command, he was with the Airways and Air Communications Service as Group Commander of the 1811th AACS Group in the Far East.

Types of Circuits

1. 60 words per minute telegraph circuit—3 fully punched cards per minute.
2. 75 words per minute telegraph circuit—4 fully punched cards per minute.
3. 100 words per minute telegraph circuit—5 fully punched cards per minute.
4. Telephone circuits (voice channel)—11 fully punched cards per minute with as much as four times this output being possible by using multiple units over the same telephone channel. When less than 80 columns per card are punched, the card volume per minute increases.

In addition to providing a more rapid method of transmitting and controlling requisitions, the IBM data transceivers provide a high degree of accuracy. This is accomplished by using an 8-bit code for transmission with each character using 4 bits of the 8. If the 4 pulses or bits received do not constitute a legitimate code due to fading signals, interruptions or transmission interference, the equipment will not punch and an error will be signalled.

LOGAIR Communications

During the early part of 1954, AMC received authorization to inaugurate an Air Freight Service. This service was first known as Mercury Service and was later renamed LOGAIR. The aircraft operation and maintenance for LOGAIR is purchased on contract while scheduling, space allocations and traffic management control is provided by HQ AMC.

The management control of this service established a new requirement for direct and expedient means of communications between air terminals. A commercial TWX service has been installed at all Air Freight Terminals to provide for a more rapid movement of critical and high value items of supply.

Transmission of Requisition and Shipping Orders

At the present time, Cheli AF Station, Maywood, California is conducting a service test to determine the communication requirements and practicability of transmitting single item requisitions and shipping orders in format. In connection with this service test a new form, which is a modified AF Form 104B, has been developed for use in sprocket feed teletypewriter machines. The received

copy is a duplicator master form from which any desired number of copies may be reproduced without retyping.

The purpose of this test is to provide AF bases with a rapid means of requisitioning high priority items direct from the appropriate AF Depot. This manner of requisitioning will also reduce administrative handling time, pipeline time and in turn reduce the inventories at bases.

Logistics Data Flow Using Electronic Computers

In May, 1954, Headquarters USAF directed the Air Materiel Command, in conjunction with the Air Research and Development Command, to develop a logistic data flow system which will have the capability of supporting our modern, jet-age striking force. Accordingly, a joint AMC-ARDC project office was established in July, 1954.

Since then, Colonel George C. McDowell, Chief, Logistical Systems Research and Planning Office, AMC, and Lt. Col. Victor A. Cherbak, ARDC representative, and a relatively small staff have made significant progress towards the goal of modernizing USAF logistics utilizing electronic data processing.

The joint AMC-ARDC project office has completed a comprehensive plan for application to the problem. This plan outlines procedures designed to improve AF logistics data flow using electronic computers and other high-speed electronic data processing equipment, including a developmental program for effecting the transition from the current system to the desired system. Present planning, projects development and completion of an integrated electronic data processing system are scheduled during the next five years.

The objectives of the integrated logistics data flow system are: increased speed of supply action; increased accuracy of supply action; better management data; balanced inventory; increased flexibility under changing conditions, and balancing of the existing ratio of approximately 75% paper work time to 25% item movement time experienced in the present supply system.

The AMC logistics data flow plan embraces comprehensive mechanization from AF base level to major echelons of supply, maintenance, procurement and distribution. As supplies logically fall into five major categories, the development plan calls

USAF/C-E . . . AMC

for five Major Materiel Control Centers and one Logistics Management Center for the control and distribution of AF logistics assets world-wide.

The Logistics Management Center and the Materiel Control Centers will be provided with large scale electronic computers and other Air Materiel area headquarters and major AF depots will be equipped with medium scale electronic computers.

At the present time, a Remington Rand UNIVAC general purpose computer is installed and operating at Headquarters AMC. This computer is jointly used by Dayton AF Depot in the developmental phase of world-wide management of electronic and armament items of supply. Within the next three months Oklahoma City Air Materiel Area will receive an IBM 702 electronic computer and Memphis AF Depot will acquire an Elecom 125 electronic computer. Oklahoma City will work in the complex area of the aircraft and engine logistics development phase, while Memphis will work in the area of general supplies. Other primary electronic computer installations are scheduled through 1956 and 1957 for San Antonio Air Materiel Area, Dayton AF Depot and Topeka AF Depot which will complete the primary nucleous for the world-wide Materiel Control Centers and the Logistics Management Center.

Reliable and Rapid Wire Links

It follows that these development areas must have communication links to implement this logistics concept. Such communications must of necessity be extensive, rapid and reliable. This area presents major problems in development of electronic means of a common language between base level input-output devices, switching centers and large scale computers with varied types of input and output codes.

The essential communications between selected development locations for the logistical data flow system in its early implementation will use existing communications facilities augmented as necessary by special purpose circuits. As the development locations become full scale operations it would appear to be necessary that a separate purely logistics communications network may be required. The speed, reliability and circuit load requirements may well dictate the requirements for such circuits.

Ultimate circuit and load requirements of the logistics data flow system cannot be accurately estimated until later on in the program. However, it is believed that communications systems and current equipment development will allow maximum use of wire lines from the standpoint of availability, reliability and economy.

As our logistics complex develops and materiel management centers are brought into operation with electronic computers and auxiliary items, it is conceivable that wire communications as such must be augmented by coaxial cable or micro-wave links.

The requirements for an adequate, speedy and reliable communications system designed specifically to serve this electronics data flow system is a project of major proportions. The combined engineering efforts of the USAF and industry will be required for successful development and marriage of the equipment and circuitry required for the Air Force logistics data flow system designed around electronic computers and satellite equipment. Through modernization, service tests and careful planning, this command will bring its communications systems into line with advanced logistics concepts.

USAF / C—E

. . . Air Research and Development Command

by Colonel Gordon T. Gould, Jr., USAF
Headquarters, Air Research and Development Command
Baltimore, Maryland

SINCE PREHISTORIC MAN FIRST threw a rock at his enemy, man has had to determine "where the target is" and "when to fire." For many centuries he relied entirely upon his human senses to "acquire" and "fire." The next step was to build sensory aids such as optical telescopes.

As long as man's mobility was limited to relatively slow speeds, he could do a reasonably effective job with his aided senses. But as the air age matured and speeds increased by several orders of magnitude, the dynamics of air warfare exceeded the limitations of the human senses. The answer has been to give man a "sixth sense" through the use of electronics.

One of the most significant trends in modern warfare is the increasing dependence and reliance upon this acquired sense. About 60% of the total output of our vast electronics industry is for the military market. Expansion of the industry has been rapid, and today, nearly 25% of all engineers and scientists in the country are engaged in electronics. In the Air Research and Development Command (ARDC) the figure runs about 30%. Even so, the demand for electronic engineers greatly exceeds the supply.

Complexity of Requirements

The increasing complexity of air warfare has necessitated a greater reliance upon electronic devices and systems. Combat aircraft are more complex because they fly higher, faster, and greater distances, and because they must be able to perform in all kinds of weather, day and night.

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As a further point, the development of nuclear weapons places added emphasis upon the need for quality in our combat aircraft and, likewise, changes completely the order of magnitude of the air defense problem. Thus, we have turned to electronics in the form of: *radar* to increase our range of vision and to see through conditions of limited visibility; *computers* to increase our thinking capacity; *servomechanisms* to supplement and, in many cases, improve our muscle power, and *automation* for increased accuracy and efficiency.

The expanded use of electronics has, of course, brought problems as well as increased capabilities. Reliability is probably the weakest link in the chain of characteristics desired for electronic devices. While a great deal of progress has been made in recent years towards improving reliability, there remains much to be accomplished through our research and development program. This is not to imply that the burden of achieving the ultimate in reliability rests solely upon our scientists and engineers, but the requirement starts with design and engineering.

There are those who have their thinking oriented to the past that ask for simplicity as the obvious answer to reliability. While complexity is expensive in many ways, it is a part of progress, and we must learn to live with it. We must achieve reliability in spite of complexity. It is always possible to over-complicate any particular device, and we must guard against this, but complicated requirements will continue to lead to complex solutions.

More Equipment for Less Space

Research and development efforts are pointed towards improving electronic tubes and components, better circuitry, easier maintenance, and techniques which will permit some component failures without causing general failure. Such things as transistors, magnetic amplifiers, printed circuits, and thermistors offer significant improvements for the future.

Turning to another problem area, electronic equipment is expensive, bulky, and heavy. There has been a continuing research and development program aimed at reducing the size and weight of electronic components. Progress in this area has been very

Colonel Gould has been in the Air Research and Development Command for five years. During this period, he has served as Chief, Armament Laboratory, Wright Air Development Center, and he is currently assigned as Chief, Radar and Communications Division, Hq ARDC. A graduate of West Point, Colonel Gould was Air Communications Officer, Hq USAAF, China Theater during World War II, and after the war he became Chief of Staff at Headquarters, Airways and Air Communications Service.

significant. Printed circuits and automatic assembly techniques have advanced markedly and offer a large number of potential advantages such as easier maintenance, less bulk and weight, faster production, and reduced cost.

The large assemblage of electronic systems and equipments which must now be installed in a combat airplane places the pilot or crew in an electronic environment. Large amounts of power are required and the danger of interference between equipments must be reckoned with. The increased speed of our aircraft aggravates the precipitation static problem and outmodes external antenna configurations that have been common. The radio compass has long been an old standby in air navigation, but precipitation static has largely negated its value in jet aircraft. Fortunately, technology has produced new methods in the form of VOR and the follow-on military TACAN system.

Jamming Strategy

The discussion thus far has pointed up a very definite trend and some of the resulting problems. Let us now examine some of the background facts which can lead to a better understanding of this trend and the related problems by considering some functional areas of applied electronics.

It is a fundamental objective in warfare to deny an enemy the means for waging war. Applying this principle to electronics, we would like to deny an enemy the use of his electromagnetic radiating devices while retaining the use of our own. The denial of these electronic aids could make a combat aircraft completely impotent as a weapon.

A realization of the importance of denying an enemy his electronic aids began in World War II. A new science was unveiled which was given the name of Electronic Countermeasures (ECM). Although ECM was used to some extent in the war, it did not show its true potential, due to the neophite state of electronic guidance and control systems and the relatively slow speed of the aircraft involved. It is evident that the situation has changed.

Generally speaking, the job of building ECM equipment is more complex than building a communications or radar set. The job of denying an enemy his electronic aids, using a limited amount of ECM equipment, requires good performance over broad bands of frequencies. Broad-band, high-power electronic devices are never easy to design or produce.

System Must Leave Little Room for Error

Up to this time it seems clear that technology has favored the offense over the defense. The development of nuclear weapons has given the airplane a position in modern warfare which validates the claims of our most foresighted aviation enthusiasts. During World War II a good air defense system could make bombing unprofitable by attriting enemy forces at a rate of 10 to 15%. Today, a good air defense system must aim for as close to a 100% kill rate as it is possible to attain.

Increased aircraft speeds and higher operating altitudes have created the need for better performing and higher powered ground radar equipments. More rapid data processing and transmission has become necessary in order to speed up the reaction time of the system. For the same reason it has become necessary to reduce the number of physical and mental processes in the chain of events which lead to intercept instructions. To sum up in a few words, the air defense job requires a

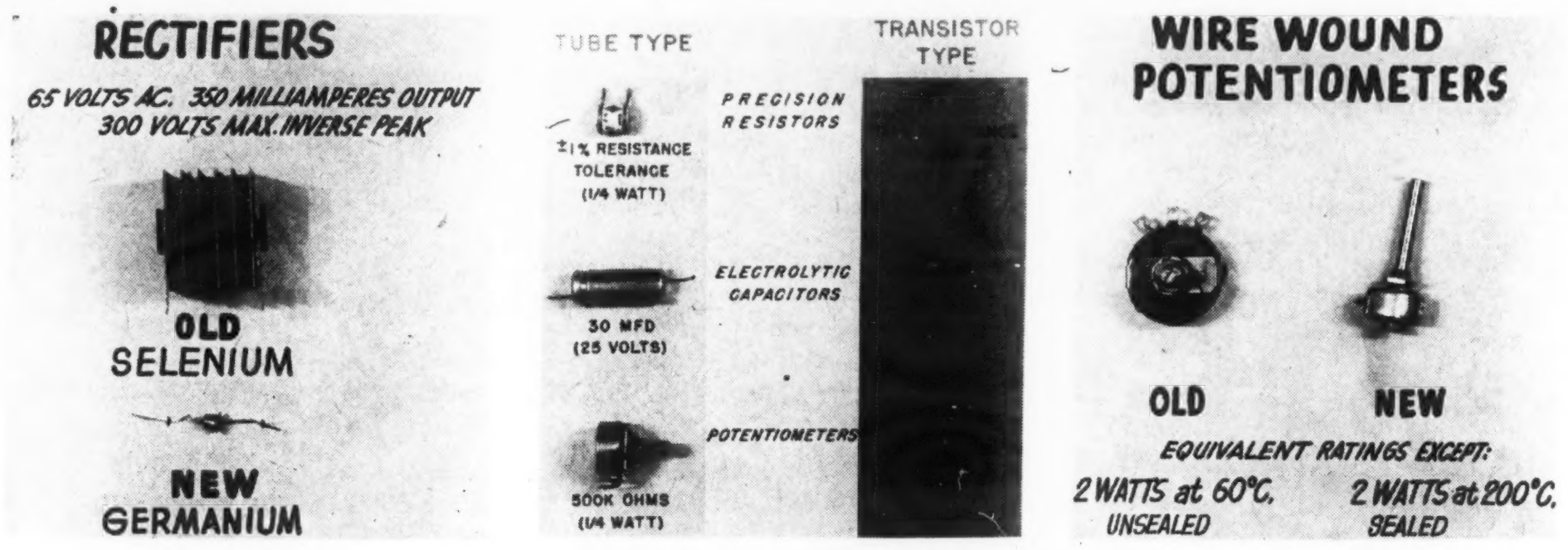
much higher kill rate against aircraft of greatly increased performance. To do this requires *detection at the greatest possible range, positive and rapid identification, interception well in advance of bomb release point and the maximum probability of kill it is possible to attain.* All of these phases involve and depend upon electronics.

The guidance and control of missiles is an area which has opened a host of new electronic research and development problems. In this case, man is no longer in the loop to monitor, insert corrections and add reasoning power to the system. Accuracy is still required, the cost of equipment failure after launch runs extremely high, and new extremes of environment are encountered. Once again, probably the greatest problem that the missile introduces is how to defend against it. Since we have missiles ready for service use and others in development, it is clear that much progress has been made.

A brief examination of the level bombing problem shows the electronic trends in this important area. Earlier bombsights depended entirely on optical sighting and tracking. The most obvious disadvantage of this method is related to the limitations of human vision under conditions of poor visibility. Next, radar bombing equipments were added as a supplement to the standard optical system necessitating the need for two operators. The accuracy of these radar systems was very poor, and the reduced crew complement of jet aircraft precluded carrying two operators. There were other deficiencies, all of which necessitated development action along the following lines:

a. Radar—Optical integration for operation by one individual who would be a radar bombardier, optical bombardier and navigator.
b. Incorporation of navigation capability. The need for this was an outgrowth of World War II experience.
c. Provision for drift correction to eliminate the need for an upwind or downwind approach to the target.
d. Improved radar range and resolution.
e. Synchronous operation employing a better computer than the impact-prediction type employed in the earlier radar bombing system.
f. Automatic pilot tie-in.
g. Provision for offset bombing capability.

These and other improvements have been accomplished, but increasing aircraft performance continues to introduce new problems and the need for an active research and development program never diminishes.



Examples of progress being made on electronic components at the Air Research and Development Command.

Investigation of Frequency Spectrum Potentialities

Turning now briefly to communications, probably the most significant trend is the expanding need to handle greater volumes of traffic. It is therefore necessary to strive continually for more efficient use of the available frequency spectrum. Increased frequency stability is one method of exercising more precise control of the spectrum. Various other techniques have been explored in the interest of bandwidth reduction. Greater channel capacity has been obtained in our airborne equipment with precise frequency control, but without the need for maintaining large crystal banks.

In the high frequency spectrum, one problem that has always plagued communicators is that of finding the optimum frequency for communication between two distant points. As a result of basic propagation research sponsored by the Air Force, equipment has been developed which will measure the radio wave skip distance. In this instance, radar pulse techniques are applied to communications problems. Information as to the skip distance at the time of a transmission is readily and instantaneously obtained.

Thinking of Future in Present Research

Communicators have long been familiar with propagation problems in the polar regions. Now that the northern polar area has assumed great strategic significance, solutions to these problems are more important than ever. The use of ionospheric and tropospheric scatter techniques are indicative of the progress that has been made.

For obvious reasons, it is not possible to discuss many aspects of our electronic research and development activities. However, it should be noted that a sound program must include two vital aspects. The first element includes *projects that are time-phased and which lead to operational equipment for field use.* To support similar projects of the future there must be continuing efforts towards advancing the state of technology. Hence, the second element includes *research and technique explorations which will lead to better equipment developments in the future.* The pressure to get something today must never be permitted to jeopardize seriously the program which looks to the future. The keynote of our research and development program is quality, and the quality that can be achieved today must rest on scientific efforts of the past.

Progress in Photographic Engineering

(*Continued from page* 35)

that is claimed to have practically the same coefficient of expansion as the optical glass used in the optical system. Consequently, all optical changes that might be caused by changes in temperature are cancelled out.

A recent development which should be of interest to photographic engineers generally is that of General Electric Company which has announced a new color control meter and variable color filter. The color control meter will enable a photographer to correctly control the color of light entering the camera lens by indicating the proper filter and exposure correction.

With the other device, a variable color filter, the photographer needs only one filter instead of the conventional assortment for control of color balance. When attached to the camera lens, the light goes through polarizing and dichroic filters that transmit bluish, neutral or reddish light, depending on the angle of polarization. Setting for the correct color balance can be read directly from the color control meter or by looking at the scene through the filter.

IV. Underwater Photography

Perhaps no line of activity in the field of photographic engineering in recent years has made more progress and occasioned more activity than that of underwater photography. When one realizes that approximately seven-tenths of the earth's surface is underwater, then one can begin to realize the vast immensity of the problem ahead to photograph this area to some degree of comparison with the earth's surface.

Since lighting is one of the big problems of photography in the dark depths of the ocean, attention is called to the Rebikoff "Torpedo" (figure 3) underwater electronic flash unit which is a pioneer in its field.

The Rebikoff "Torpedo" electronic flash unit is constructed in the shape of an elongated watertight tube containing propeller motor, batteries and electronic flash mechanism. The "Torpedo" is made watertight by means of self-sealing gaskets and is practically weightless underwater. The "Torpedo" is electrically protected by application of the Faraday cage principle. It is available in several sizes and also may be obtained for continuous lighting rather than flash.

Another item of considerable interest in underwater photography is the Leica underwater housing which accommodates the new IIIf Leica Camera. The housing is completely watertight, with all controls operable from outside. Both the "Torpedo" electronic flash and the Leica housing are available in the U. S. from the Alfa Photo Corp. of New York City.

Three other items available in the U. S. from the Fenjohn Underwater Photo & Equipment Co. of Ardmore, Pa. are: the Rolleiflex Still Camera housing made by Franke & Heidecke Co. of Germany; the "Goggler" (figure 4) underwater still camera which uses 120mm or 70mm film, and the "Bantam" 16mm motion picture camera housing.

This special phase of photography is relatively untouched and its techniques and equipment are rapidly extending into fields where watertight housings are deemed a necessity. Such applications as rain-forests, low temperature and desert environments, surgical operating rooms, mines, underwater television and anywhere that dust or gas proof housings are required, offer a golden field of expansion.

The Role of Management in Industrial Defense

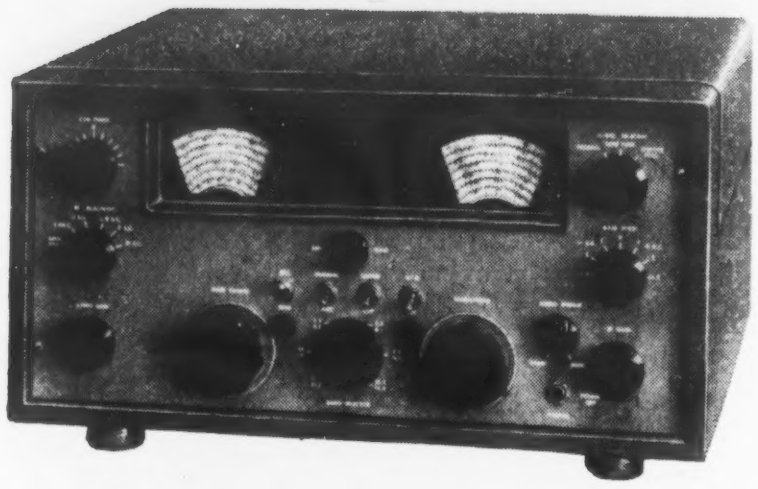
(*Continued from page* 38)

A company whose plants or plant are vulnerably located might identify, from among existing dispersed facilities producing consumer goods, those which were most suitable to the production of the company's product. Tentative arrangements could then be made to transfer production to the non-vulnerable plant in the event the plant is destroyed. Consideration should also be given to pre-attack arrangements for wartime sharing of know-how, including patents and licenses, scarce skills, technical knowledge and managerial staffs, when necessary to prevent production delays in event of attack.

The foregoing is an attempt to brief a large subject. A very helpful check-list of steps to be taken in setting up an industrial defense plan for a company will be found in a booklet prepared for BDSA by the American Iron and Steel Institute. The principles set forth and the points listed are in large measure applicable to all industry and not limited to the steel industry. The same is true of the booklet, "Disaster Planning for the Oil and Gas Industries," recently released by the National Petroleum Council.

New Address?

Send it to us *promptly*, so that you won't miss an issue of SIGNAL.



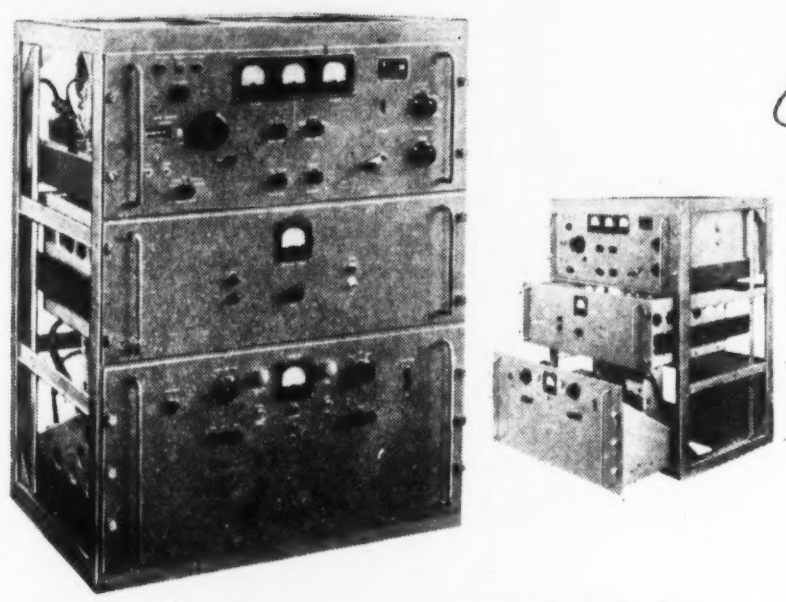
BULLETIN 179

COMMUNICATIONS RECEIVER

MODEL GPR-90

The GPR-90 is a 15 tube double conversion superhetrodyne communication receiver covering the frequency range of .54 to 31 mc in six accurately calibrated bands with full electrical bandspread. This Receiver features the same precision construction as our other units, and we believe it to be the finest receiver available in its price class. Complete details available on request.

RADIO TRANSMITTER



BULLETIN 174

MODEL GPT-750

The TMC GPT-750 transmitter was designed for radio telephone, telegraph, frequency shift and facsimile operation on all frequencies within the range of 2 to 32 mc. This transmitter is conservatively rated at 900 watts output CW or FS and 500 watts output radio telephone, continuous commercial service. It will easily accept one kilowatt input, either phone, CW or FS, intermittent commercial and amateur service. Constructed on a building block basis, many combinations are available to provide for all the commonly used services. Accessories to further extend its versatility are: the model RTC, a remote control amplifier containing speech clipping low level microphone input, keying input, and remote control of plate supply; and the model RTF Master Oscillator-Amplifier for multi-channel operation. Complete details on all these are available on request.

ANTENNA TUNING UNIT

BULLETIN 163

MODEL TAC

The TAC Antenna Tuning Unit was specially designed for operation with the BC-610 or T-368( ) URT transmitters, but may also be used to match any transmitter with a normal output impedance of 70 ohms to BALANCED or UNBALANCED loads ranging from 50 to 1200 ohms. The unit is capable of handling 500 watts of RF over the frequency range of 2 to 30 mcs. and phycically replaces the BC-939. Complete details on request.

THE TECHNICAL MATERIEL CORPORATION

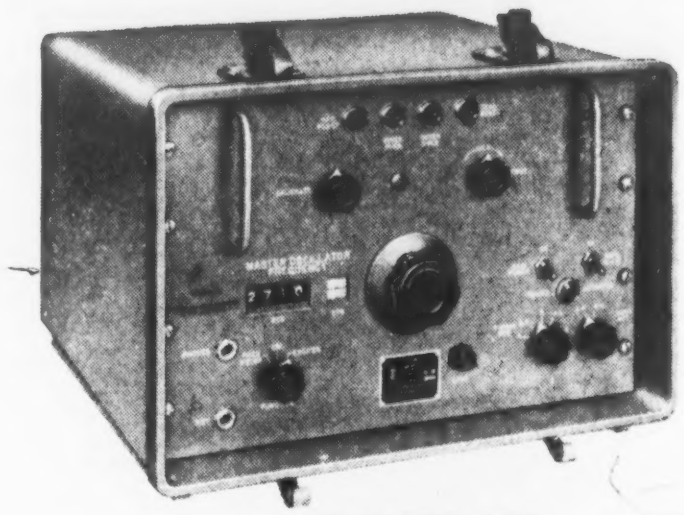
In Canada: OTTAWA, ONTARIO

MAMARONECK, N. Y.

MASTER OSCILLATOR and HETERODYNE FREQUENCY METER

MODEL PMO

The PMO is an oven controlled high stability portable master oscillator—readable and resettable to better than 20 parts/million. Direct reading in cycles over the basic range of 2 to 4 mc. The PMO is used as a highly stable transmitter exciter, frequency meter, or receiver calibrator and is packaged in a fibre-glass reinforced plastic case for portable field application or as a rack mounted unit for fixed station and laboratory use.



BULLETIN 173

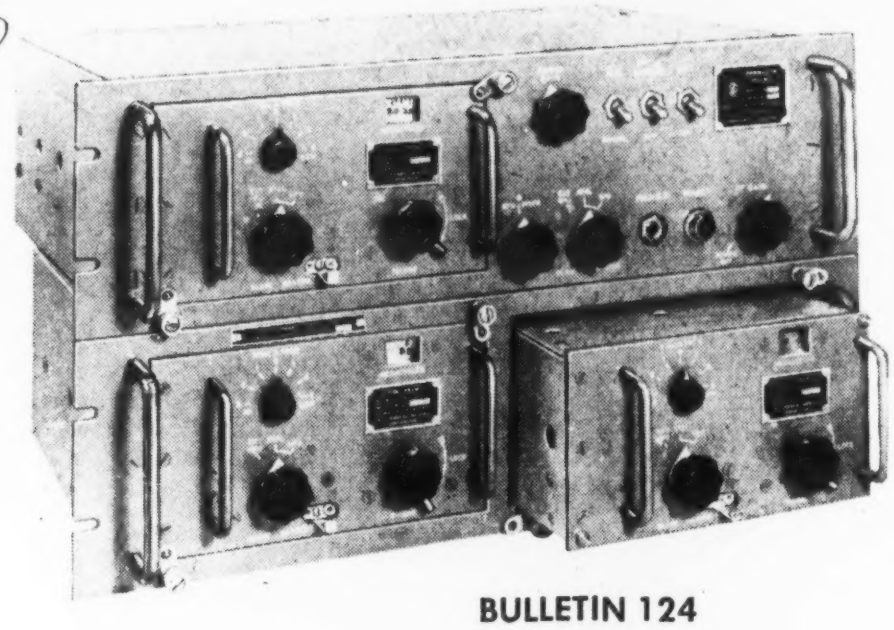
COMMUNICATIONS RECEIVER

MODEL FFR

AN/FRR 502

The Model FFR has been designed to fulfill the long existing need for a sturdy easily tunable, single frequency receiver, which will provide maximum flexibility and thoroughly dependable, unattended, continuous reception of AM radio telephone, CW telegraph or Teletype, and MCW telegraph signals.

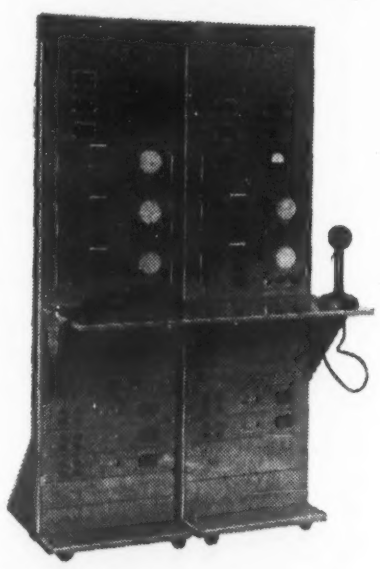
The FFR covers a range of 50 kc to 32 mc by means of plug-in drawers, with provision for both crystal and VFO operation of the HFO & BFO. Remote control facilities have been provided on the rear so that the HFO, BFO & RF gain may be controlled on a DC basis. In the TMC RCR system, control of the HFO, BFO and sensitivity is accomplished on a tone basis plus provision for on/off control of the AVC & BFO. Complete details of the many uses of the FFR are available on request.



BULLETIN 124

REMOTE CONTROL SYSTEM

CONTROL TERMINAL



MODEL RCR

AN/FRA 501

The TMC remote control system, model RCR-5 provides 15 vernier and 10 on/off control functions on a tone basis. The complete versatility of the system is evidenced by its ability to function with local control sites physically dispersed over a wide area. An operator, by manipulation of control knobs, may remotely control the activity of such devices as receivers, missiles, detonator, telemetering apparatus, etc. The illustration shows the RCR-5, a complete 5 channel (25 controls) system with the FFR receiver as the controlled device. Complete details of the full functions and operation of the RCR are available on request.

REMOTE TERMINAL

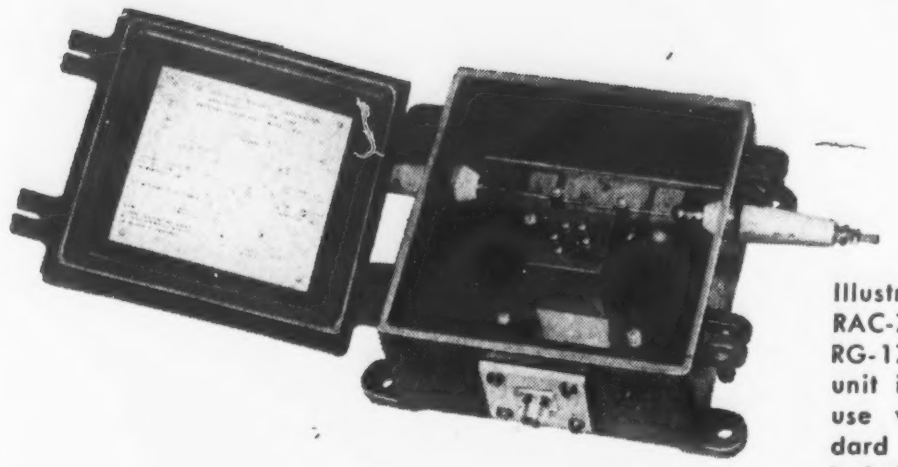
BULLETIN 124B

THE TECHNICAL MATERIEL CORPORATION

In Canada: OTTAWA, ONTARIO

MAMARONECK, N. Y.

RHOMBIC ANTENNA COUPLER



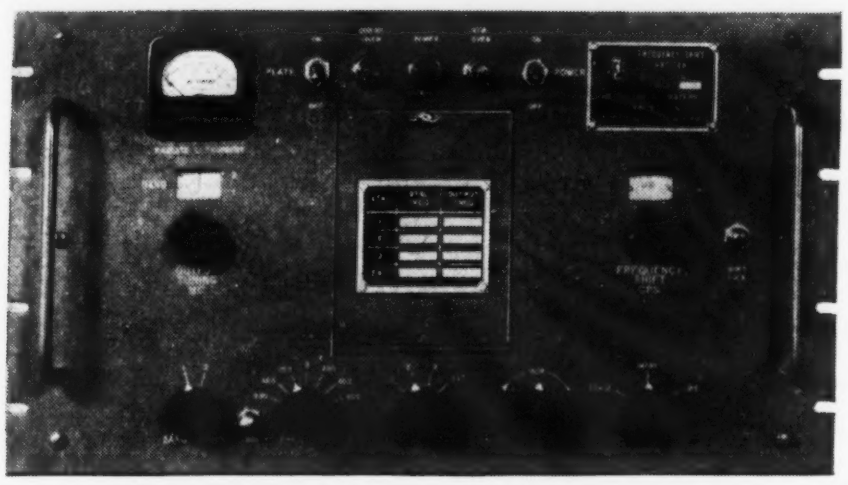
Illustrated is Model RAC-7 for use with RG-17/U cable. The unit is available for use with any standard coaxial cable including Styroflex. Other transformation characteristics available.

MODEL RAC

The RAC is a broadbanded transformer designed to couple a coax transmission line to a receiving rhombic. It is one of a series of broadband transformers designed by TMC and provides impedance matching from 700 ohms to 70 ohms flat within 3 db from 2 to 60 mc. Protection from static charges and DC checking of continuity of the antenna and transmission line are provided. Complete details on request.

BULLETIN 112

FREQUENCY SHIFT EXCITER



MODEL XFK

The XFK is a highly stable exciter which replaces the crystal oscillator in the transmitter to provide "mark & space" carrier-shift transmission of teleprinter, telegraph, FM telephone, facsimile or telephoto intelligence. Carrier shift up to 1000 cps available either linear, with applied voltage or independent of applied voltage. Frequeny range, 1.0 to 6.9 Mc in two bands. Complete details available on request.

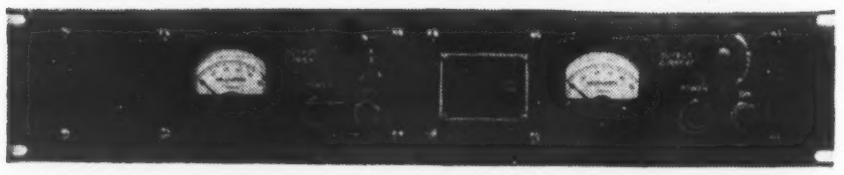
BULLETIN 118

FREQUENCY SHIFT CONVERTER

BULLETIN 120

MODEL CFA

The CFA converter is used in radio-teletype frequency shift receiving systems to convert the "mark & space" tones from the output of a receiver in a diversity system into DC pulses capable of operating a teletypewriter, tape recorder etc. The CFA is an audio type dual channel converter for use with diversity or single receiver systems. Compact and easy to service, the CFA provides maximum circuit efficiency with a minimum of opeartor effort and skill. **NARROW SHIFT** models for LF applications available. Details on request.



BULLETIN 121

MODEL PSP

The PSP provides a source of DC current for use in communications circuits, where DC battery is used for keying relays, teleprinter equipment or any other similar terminal equipment. The PSP was designed to provide steep wave front when keyed to promote more positive action of relay or magnet operated equipment and can be used with the CFA to provide loop current. Available in single or dual units. Complete details on request.

THE TECHNICAL MATERIEL CORPORATION

In Canada: OTTAWA, ONTARIO — MAMARONECK, N. Y.

1624 Eye Street, NW
Washington 6, D. C.
Phone: EXecutive 3-3033

Association Affairs

1956 CONVENTION TAKES SHAPE

With the recent appointment of Captain David R. Hull, USN (Ret.), Raytheon Mfg. Co., as chairman of the 10th Annual AFCEA Convention, the Boston Chapter began its work on the meeting to be held May 24, 25 and 26, 1956. Vice chairman of the convention committee is Gardiner G. Greene, president of the Chapter.

Hotel arrangements have been completed with the Hotel Statler in Boston. For the first time in AFCEA history, the exhibits are limited to an "all-industry" show, with displays to be located in the First Corps Cadet Armory near the hotel. The exhibit arrangements are being handled by William C. Copp.

Signal Corps ROTC Camp Award

Cadet Randall A. Odom of Texas College of Arts and Industries was the recipient of the Association's annual award to the outstanding cadet of the Signal Corps ROTC Summer Camp.

Major General James D. O'Connell, Chief Signal Officer, presented the gold medal and scroll to Cadet Odom at the final camp ceremony at Camp Gordon on August 5th.

This award is given for outstanding leadership and superior technical knowledge of communications and electronics during the period of camp training.

Companies Accepted for AFCEA Group Membership Since July 1, 1955

***Coastal Publications Corporation, New York, New York**

†Wac Engineering Company Dayton, Ohio

†Webster-Chicago Corporation, Government Division Chicago, Illinois

***Brief notes about this company appear on this page.**
†Brief notes about these companies will appear in the November-December issue.

437 new AFCEA individual members from July 1 to September 1

Introducing AFCEA's New Group Members

Coastal Publications Corporation

A recent addition to the AFCEA group members is the Coastal Publications Corporation, specializing in the preparation of technical publications. The firm is located in New York City.

Individual members of this new group member who will represent their company in the AFCEA are: Jesse A. Bolander, president; Edgar Gallerstein, vice president; Robert Stein, editor-in-chief; Joseph Kelleher, sales engineer; Jerome Berman, project director; William Snow, project director; Milton Lowe, project director; Jerry Kalawsky, production manager; H. Meier, project director and Julian Albert, project director.

Holtzer-Cabot

The Holtzer-Cabot Division of the National Pneumatic Company, Inc., of Boston, manufacturers of rotating electrical equipment, became a group member of AFCEA during June.

Serving as company representatives in the Association will be: Richard H. Frost, president; James J. Anderson, vice president and general sales manager; Robert Frost, vice president of marketing; Harvey J. Finison, executive vice president and director of engineering; Mortimer Ackerman, controller; Michael Leo Looney, manager of the Washington office; Lt. Col. Angus J. Walker, director of purchases; Cyrus Wood, product planning manager; Arthur V. Malloy, government sales engineer, and Miss Nora Ford, contracts administrator.

Microwave Associates, Incorporated

Another company which has received a group membership in the AFCEA is Microwave Associates, Incorporated, manufacturers of microwave tubes, semiconductors and components, of Boston, Mass.

The following members of the company are AFCEA company representatives: D. W. Atchley, Jr., president; V. Chigas, treasurer and general manager; R. M. Walker, vice president and chief engineer; W. P. Toorks, vice president and produc-

tion manager; J. Pathe, vice president and head, magnetron engineering; J. C. Bothwell, business manager and comptroller; H. I. Ellowitz, head, crystal engineering; D. Lanciani, head, microwave component section; E. Stromsted, sales engineer, and R. Fitz, assistant to the general manager.

Page Communications Engineers, Incorporated

The AFCEA welcomed in June another new group member, Page Communications Engineers, Incorporated, Washington, D. C., a company engaged in the design and installation of long distance, point-to-point radio and communications systems.

Those officials who will serve as AFCEA representatives under this group membership are: Joseph A. Waldschmitt, executive vice president; Clifton F. Foss; James L. Hollis; Charles J. Seeley; Paul D. Rockwell; William H. Collins; David F. Brittle, Jr.; G. Porter Houston, and William E. Yost, Jr.

Technical Materiel Corporation

The Technical Materiel Corporation of Mamaroneck, New York, joined the AFCEA in June. This company specializes in those fields related to communications engineers.

AFCEA company representatives under this new group membership will be: R. H. dePasquale, president; W. J. Galione, executive vice president; E. A. Matson, Jr., vice president; J. Toman, plant superintendent; A. J. Jurafsky, senior engineer; W. L. Deans, vice president; G. T. Orefice, senior engineer; H. Herz, junior engineer; A. R. Bernardi, junior engineer, and J. E. Galione, sales manager.

L. A. Connelly Dies, RCA Executive

Louis A. Connelly, for 13 years manager of the Government Department, Engineering Products Division of the Radio Corporation of America, died at his home in Medford Lakes, New Jersey.

Mr. Connelly had been with RCA and predecessor companies since 1924 and was widely known throughout Government circles. His career had been devoted to Government sales activities, and he was cited for his expert planning and coordination of RCA activities to meet the demand for military electronic equipment after the outbreak of the Korean hostilities.

1955 AFCEA-ROTC AWARDS

THE ASSOCIATION'S ANNUAL GOLD Medal Honor Awards to outstanding senior ROTC, AFROTC and NROTC students majoring in electrical engineering were made at ninety-eight colleges and universities this spring. In some cases, chapters made awards to underclassmen.

Typical of the enthusiastic comments concerning these awards is the following:

"These recognitions of merit given by a senior society, made up of men of proven stature in the communications and military professions, serve as a great incentive to our undergraduate students, and it is my sincere hope that the AFCEA will continue to make such awards possible."

J. P. CAMPBELL, Colonel, CE
PMST. Carnegie Tech

The honor roll of award winners is as follows:

A & M College of Texas
Allen R. Heimer, *Army*
Francis B. O'Donnell, *Air Force*
Alabama Polytechnic Institute
William C. Burgin, *Army*
California Institute of Technology
Hugh G. Leney, *Air Force*
Carnegie Institute of Technology
James D. Meindl, *Army*
George P. Lang, *Army* (jr.)
Terry E. Sharp, *Army* (soph.)
Case Institute of Technology
Charles E. Radke, *Air Force*
The Citadel
Donald C. Latham, *Air Force*
Clarkson College of Technology
William K. Springfield, *Army*
Clemson Agricultural College
Elton M. Calder, *Army*
Thomas C. Drew, Jr., *Air Force*
Colorado A & M College
Robert C. Mayberry, *Army*
William J. Gunther, *Air Force*
Columbia University
Herbert M. Zydney, *Air Force*
Cornell University
John R. Peaslee, *Army*

Georgia Tech. The three award winners are, left to right: Robert H. Watkins, Army; George T. Bostic, Navy; and Walter M. Rogers, Jr., Air Force. Lt. Col. Donald L. Adams, Signal Section, Hq 3rd Army, is making the presentation.

Washington University. Col. Robert H. Conk, Chief of the Missouri Military District, presents the AFCEA medals to Air Force Cadet John K. Dixon and Army Cadet Ronald J. Winkler. Looking on are Col. H. N. Burkhalter, Jr., PAS, and Col. W. G. Stephenson, PMS&T.

Rodney M. Rougelot, *Navy*
Ronald E. Jorasch, *Air Force*
Dartmouth College
Arthur J. Mackey, Jr., *Navy*
Duke University
Charles E. Seager, *Navy*
Georgia Institute of Technology
Robert H. Watkins, *Army*
George T. Bostic, *Navy*
Walter M. Rogers, Jr., *Air Force*
Howard University
Henry L. Donald, *Air Force*
Illinois Institute of Technology
Michael J. Elsen, *Air Force*
Iowa State College
Robert V. Donaldson, *Army*
John E. Ryburn, *Navy*
Raymond D. Schlueter, *Air Force*

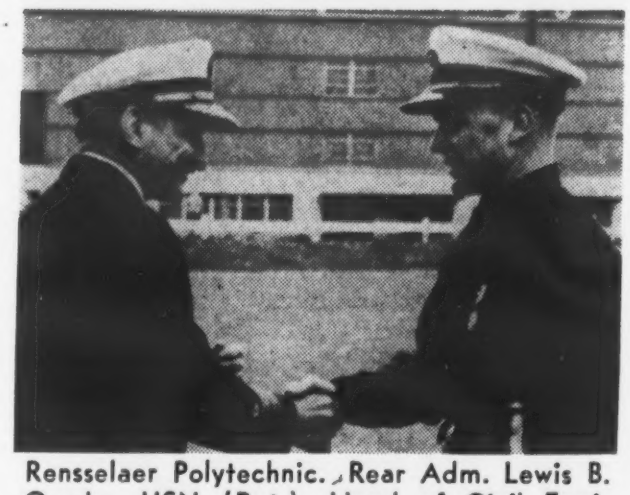
University of Utah. Brig. Gen. H. Lynn Ostler pins the medal on Air Force Cadet Gary B. Lyman.

Michigan State. Col. Harry W. Gorman congratulates Army award winner Richard A. Allen.

Stanford University. Dean H. Winbigler, Dean of Men, awards medal to Air Force Cadet Vernon E. Dunn.

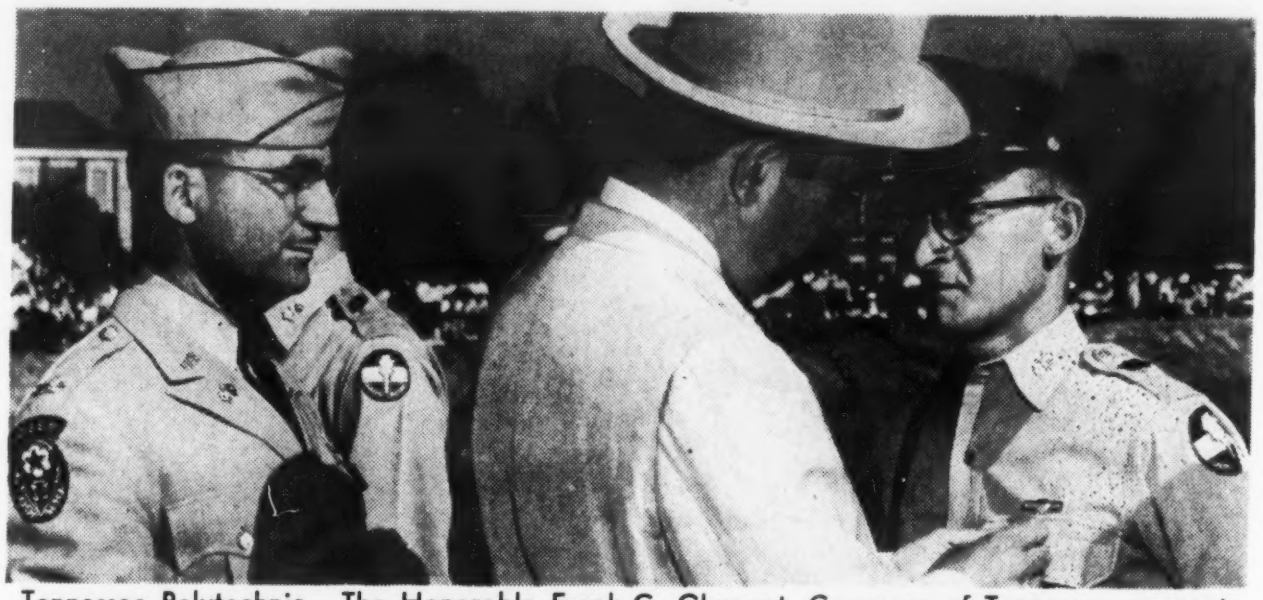
AFCEA-ROTC AWARDS

Lehigh University
Richard W. Granville, *Air Force*
Louisiana Polytechnic Institute
Tony G. Williams, *Air Force*
Manhattan College
Henry E. Weseman, *Air Force*
Marquette University
Michael J. Hadfield, *Navy*
Massachusetts Institute of Technology
Henry C. Collias, *Army*
Thomas W. Stockham, Jr., *Air Force*
Michigan College of M & T
Charles A. Robertson, *Air Force*
Michigan State College
Richard A. Allen, *Army*
Mississippi State College
Billy T. House, *Air Force*
Newark College of Engineering
Gordon R. Schwarz, *Air Force*
New York University
Martin P. Ontell, *Army*
North Carolina State College
Edwin S. Crow, Jr., *Air Force*
North Dakota Agricultural College
Ralph L. Welken, *Air Force*
Northeastern University
James H. Phillips, *Army*
David M. Priestly, *Army* (jr.)
Nicholas A. Mineo, *Army* (soph.)
Norwich University
Alfred H. Ward, *Army*
Ohio State University
Robert L. Lyon, *Army*
Oklahoma A & M College
William G. Harts, *Army*
Wally M. Wallingford, *Air Force*
Oregon State College
William F. Toole, *Army*
James P. McClure, *Air Force*
Pennsylvania State University
Richard B. Feicht, *Army*
William E. Happerstett, Jr., *Navy*
Clark G. Fiester, *Air Force*
Princeton University
George Kovatch, *Air Force*
Purdue University
Army winner not reported
Edward S. Bottum, *Navy*
Earl J. Andrews, Jr., *Air Force*
Rensselaer Polytechnic Institute
Christopher O. Riddleberger, *Army*
Howard J. Charles, Jr., *Navy*
James F. Ingle, *Air Force*
Rutgers University
F. L. Adams, *Army*
AF winner not reported



Rensselaer Polytechnic. Rear Adm. Lewis B. Combs, USN (Ret.), Head of Civil Engineering Dept., congratulates Midshipman Howard J. Charles, Jr.

Rensselaer Polytechnic. Col. Charles S. Kuna, PMS&T, presents the AFCEA Gold Medal to Christopher O. Riddleberger, outstanding Army ROTC senior.



Tennessee Polytechnic. The Honorable Frank G. Clement, Governor of Tennessee, presents the AFCEA medal to Army Cadet Joseph B. Ottinger. Looking on is Col. N. C. Angel, then PMS&T, now assigned to the Joint Communications-Electronics Committee, Joint Chiefs of Staff.

St. Louis University
Bernard J. Rice, *Air Force*
Southern Methodist University
Leslie R. Beddoes, Jr., *Air Force*
Southwestern Louisiana Institute
Kelly L. DeLoache, *Air Force*
Stanford University
Vernon E. Dunn, *Air Force*
State College of Washington
Charles O. Walters, *Army*
State University of Iowa
John V. Wait, *Air Force*
Syracuse University
Charles S. Shaw, *Air Force*
Tennessee Polytechnic Institute
Joseph B. Ottinger, *Army*
Texas College of A & I
Gary L. Fenner, *Army*
Randall A. Odom, *Army* (jr.)
Texas Technological College
Carl W. Green, *Army*
Charles A. Holmquist, *Air Force*
Tufts College
Domenic S. Terranova, *Navy*
Robert E. Surtees, *Air Force*
Tulane University of Louisiana
Merlin E. Louapre, *Navy*
Hero J. Edwards, Jr., *Air Force*
Union College
Kenneth B. Haefner, *Air Force*
University of Akron
Donald H. Lambing, *Air Force*
University of Alabama
Reinhold H. Dietz, Jr., *Army*
University of Arizona
Kenneth L. Hanson, *Air Force*
University of Arkansas
Joe C. Culp, *Army*
William T. Stewart, *Air Force*

(*Continued on page* 56)

M.I.T. Boston Chapter Director Raymond B. Meader presents the awards to Harry C. Collias, Army, and Thomas W. Stockham, Air Force.

University of Washington. Left to right, Col. George H. Dietz, PAS, President Henry Schmitz, and Air Force Cadet James L. Russell.

AFCEA-ROTC AWARDS

University of Buffalo
William A. Manning, *Air Force*
University of California (Berkeley)
William F. Colescott, *Army*
University of California (L. A.)
Floyd L. Cannon, *Air Force*
University of Cincinnati
John W. Pan, *Air Force*
University of Colorado
Ronald L. Johnson, *Army*
University of Connecticut
Lee J. DesJardins, *Army*
John P. Brailey, *Air Force*
University of Delaware
M. John McDaniel, *Army*
University of Denver
Edward R. Young, *Army*
University of Detroit
Eugene N. Schalk, *Air Force*
University of Florida
Jimmy Page, *Air Force*
University of Idaho
Ralph E. Townsend, Jr., *Air Force*
University of Illinois
Frank L. Battuello, *Army*
Richard G. Bemis, *Navy*
Larry D. Smith, *Air Force*
University of Kansas
Donald D. Smith, *Navy*
Homer R. Montgomery, *Air Force*
University of Kentucky
Joseph C. Cooke, *Air Force*
University of Louisville
Frank E. Brinegar, *Navy*
University of Maryland
Dale H. Jackson, *Air Force*
University of Massachusetts
John C. Goclowski, *Army*
Robin B. Lewis, *Air Force*
University of Miami
David C. Wensley, *Air Force*
University of Michigan
David W. Zerbel, *Navy*
University of Minnesota
Richard A. Browman, *Army*
Edward Bauman, *Air Force*
University of Missouri
William P. Waite, *Army*
Charles F. Kircher, *Air Force*
University of Nebraska
Gerald W. Eriksen, *Navy*
Kenneth W. Philbrick, *Air Force*
University of New Hampshire
Leonard E. Bernier, *Air Force*
University of Notre Dame
Navy winner not reported
Thomas A. Sutherland, *Air Force*
University of Oklahoma
Cleon W. Winslow, *Navy*
Earl R. Norman, *Air Force*
University of Pennsylvania
Dan J. DiGiovacchino, *Navy*

University of Kentucky. Dr. Harry A. Romanowitz awards medal to Joseph C. Cooke, Air Force.

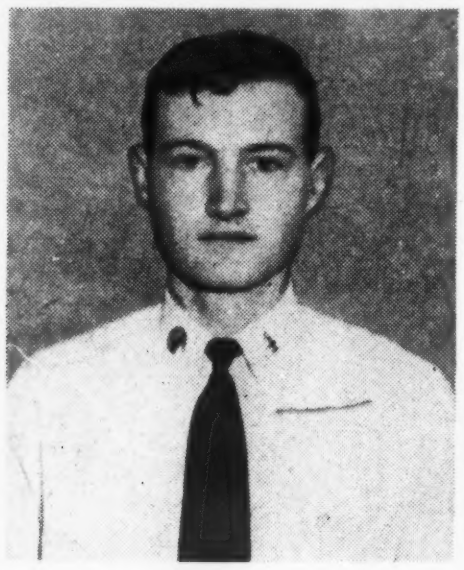
West Virginia University. Dr. Roland P. Davis, Dean of Engineering, pins medal on Edwin C. Jones, Jr., Army.

University of Minnesota. Dean A. F. Spilhaus presents the award to Richard A. Browman, Army.

Charles A. Holmquist, AF
Texas Technological College

Raymond D. Schlueter, AF
Iowa State College

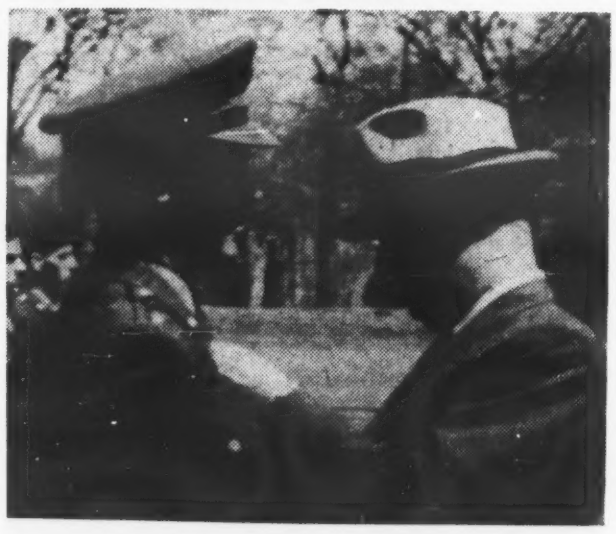
Elton M. Calder, Army
Clemson Agricultural College



Richard W. Groth, AF
University of Wisconsin

University of Nebraska. Award is presented to Kenneth W. Philbrick, AF, by Roy M. Green, Dean of Engineering.

Worcester Tech. Army Cadet Charles F. Walters is awarded the medal by President Arthur Bronwell.

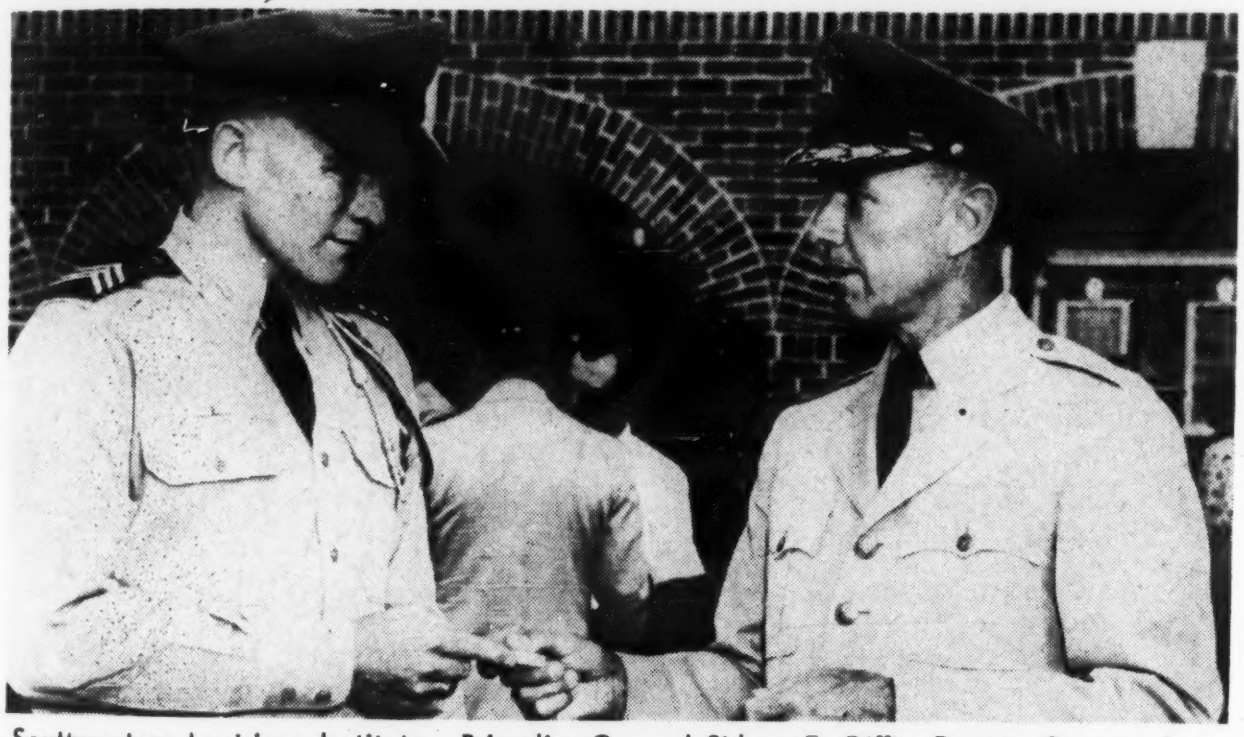


Purdue University. Prof. J. S. Johnson, Electrical Engineering Head, congratulates Philip A. Kingsley, Army.

AFCEA-ROTC AWARDS

University of Pittsburgh
Andrew Revay, *Air Force*
University of South Carolina
George M. Rider, *Navy*
University of Tennessee
James H. Culp, *Air Force*
University of Texas
Robert F. Gribble, *Navy*
Benny F. Johnson, *Air Force*
University of Toledo
Herbert E. Shodiss, *Army*

Northeastern University. Boston Chapter President David R. Hull congratulates James H. Phillips, gold medal winner. On the left is David M. Priestley, silver medal winner.



Southwestern Louisiana Institute. Brigadier General Sidney F. Giffin, Deputy Commandant, Air War College, presents the AFCEA medal to Air Force Cadet Kelly L. DeLoache.

Carnegie Tech. Awards were presented by Pittsburgh Chapter officials. L to R: Andrew N. Galone; James D. Meindl, gold medal winner; Hal A. Lundberg; George P. Lang, silver medal; John I. Seitz; and Terry E. Sharp, bronze medal.

University of Utah
Gary B. Lyman, *Air Force*
University of Washington
Robert J. Vogel, *Navy*
James L. Russell, *Air Force*
University of Wisconsin
James P. McNaul, *Army*
Richard W. Groth, *Air Force*
University of Wyoming
Kenneth J. Payne, *Air Force*
Utah State Agricultural College
Allan W. Shaw, *Army*
Vanderbilt University
James N. Holeman, Jr., *Army*
James G. Givens, *Navy*
Villanova University
Richard D. Burke, *Navy*
Virginia Polytechnic Institute
Robert E. Diggs, *Army*
Ashton E. Violette, *Air Force*
Washington University
Ronald Winkler, *Army*
John K. Dixon, *Air Force*
West Virginia University
Edwin C. Jones, Jr., *Army*
Thomas H. Van Landingham, *Air Force*
Worcester Polytechnic Institute
Charles F. Walters, *Army*

Attention: ROTC Award Winners

Your award entitles you to a full year's membership in the AFCEA. Please send us your current address so that you will receive SIGNAL and the News Letter on time.

Guns that aim

DELCO SKILL DOES IT!

The pilot guides the plane; the electronic system of the A-4 fire-control unit tracks the target, day or night, for automatic fire control of guns, bombs or rockets—giving the pilot more time to concentrate on flying a streaking jet. The electronic systems built by Delco Radio play a vital part in these high-speed air battles.

...themselves

DELCO RADIO HELPS BUILD—

T-38 SkySweeper, self-aiming anti-aircraft gun.

AN/TRC-32 transportable control towers for airfields.

R-390 all-purpose receiver for the Army Signal Corps.

Delco Radio's experience and manufacturing skill are contributing to the low-cost production of radio, radar and electronic systems for military equipment.

Delco Radio has at its command the largest integrated manufacturing facilities in the electronic field, so that it is able to produce from raw materials to finished product, more economically than ordinary assembly subcontractors.

This "under one roof" manufacturing offers purchasers still other advantages—coordinated scheduling, uniform product quality, and on-time delivery.

Delco Radio is ready *now*. For low-cost on-time production of electronic systems of high uniform quality, see Delco Radio.

DELCO RADIO
DIVISION OF GENERAL MOTORS
KOKOMO, INDIANA

DELCO RADIO HAS BUILT

- PULSED GLIDE PATH LANDING EQUIPMENT
- TAIL WARNING RADAR
- NAVIGATIONAL DRIFT INDICATORS
- ENGINE DETONATION INDICATORS
- OXYGEN FLOW INDICATORS
- LORAN RADIO RECEIVERS
- AM AND FM RADIO RECEIVERS AND TRANSMITTERS
- RADAR COUNTERMEASURE EQUIPMENT
- RAZON BOMB CONTROLS
- RT-70 RECEIVER-TRANSMITTERS
- M-403 PROXIMITY FUSES
- R-390 ALL-PURPOSE RECEIVER COMPONENTS

DELCO RADIO IS BUILDING

- A-4 GUNSIGHT-ROCKET AMPLIFIERS
- T-38 SKYSWEEPER ELECTRONIC SYSTEMS
- AN/TRC-32 TRANSMITTER-RECEIVER FOR CONTROL OF AIRFIELDS
- AN/GRC-27 TRANSMITTER AND RECEIVER

DELCO RADIO CAN HELP YOU BUILD

- VEHICULAR COMMUNICATION EQUIPMENT
- TRANSMITTERS AND RECEIVERS
- AIRBORNE COMMUNICATIONS—RADAR
- PACK OR PORTABLE COMMUNICATIONS EQUIPMENT
- ELECTRICAL COMPONENTS
- ELECTRONIC CONTROLS FOR GUIDED MISSILES

AFCEA Group Members

Communications—Electronics—Photography

Listed below are the firms who are group members of the Armed Forces Communications and Electronics Association. By their membership they indicate their readiness for their share in industry's part in national security. Each firm nominates several of its key employees or officials for individual membership in AFCEA, thus forming a group of the highest trained men in the electronics and photographic fields, available for advice and assistance to the armed services on research, development, manufacturing, procurement, and operation.

Admiral Corporation
Air Associates, Inc.
Aircraft Radio Corp.
Allied Control Co., Inc.
Allied Radio Corporation
Almo Radio Company
American Cable & Radio Corp.
American Electronic Laboratories, Inc.
American Institute of Electrical Engineers
American Machine & Foundry Co.
American Phenolic Corporation
American Radio Relay League
American Telephone & Telegraph Co.
Ampex Corporation
Anaconda Wire & Cable Company
A. R. F. Products, Inc.
Argus Cameras, Inc.
Arnold Engineering Company
Atlas Precision Products Co.
Audio Products Corporation
Automatic Electric Company
Automatic Electric Sales Corp.
Automatic Telephone & Electric Co., Ltd.
Barry Controls, Inc.
Bell Telephone Company of Pa.
Bell Telephone Laboratories, Inc.
Bendix Radio
Berkshire Transformer Corp.
Bliley Electric Company
Bomac Laboratories, Inc.
Bruno-New York Industries Corp.
Burnell & Company
California Water & Telephone Co.
Cambridge Thermionic Corp.
Capitol Radio Engineering Inst., Inc.
Cargo Packers Inc.
Carolina Telephone & Telegraph Co.
Central Technical Institute
Chesapeake & Potomac Tel. Co.
Cincinnati & Suburban Bell Tel. Co.
*Coastal Publications Corp.
Collins Radio Company
Contraves Italiana
Control Engineering Corp.
Copperweld Steel Company
Cornell-Dubilier Electric Corp.
Craig Systems, Inc.
Crosley Division-Avco Mfg. Corp.
Dana, P. A., Inc.
Designers for Industry, Inc.
De Vry Technical Institute
Diamond State Telephone Co.
Dictaphone Corporation
Downing Crystal Company
Dukane Corporation
DuMont, Allen B., Laboratories, Inc.
Eastman Kodak Company
Electronic Associates, Inc.
Electro Tec Corporation
Elgin Metalformers Corporation
Espey Manufacturing Co., Inc.
Farnsworth Electronics Company
Federal Telecommunication Laboratories
Federal Mfg. and Engineering Corp.
Federal Telephone & Radio Corp.
General Aniline & Film Corp.
General Cable Corporation
General Communications Co.
General Electric Company
General Telephone Corp.
General Transformer Co.
Gilfillan Bros., Co.
Globe Wireless, Ltd.
Gray Manufacturing Co.
Guardian Electric Mfg. Co.
Hallicrafters Company, The
Haloid Company
Hammarlund Manufacturing Co., The
Hazeltine Electronics Corp.
Heinemann Electric Company
Hercules Motor Corp.
Hitemp Wires, Inc.
Hoffman Laboratories, Inc.
Holtzer-Cabot Division, National Pneumatic Co., Inc.
Hopkins Engineering Co.
Hughes Aircraft Company
Illinois Bell Telephone Co.
Indiana Bell Telephone Co.
Indiana Steel & Wire Co.
Industrial Development Engineering Associates, Inc.
Institute of Radio Engineers
International Business Machines
International Resistance Co.
International Tel. & Tel. Corp.
Jacobsen Manufacturing Co.
Jansky & Bailey, Inc.
Kay Lab
Kellogg Switchboard & Supply Co.
Keystone Electronics Co.
Kleinschmidt Laboratories, Inc.
Lavoie Laboratories
Leich Sales Corporation
Lenz Electric Manufacturing Co.
Lewyt Corporation
Librascope, Inc.
Loral Electronics Corporation
Machlett Laboratories, Inc.
Magnavox Company
Maida Development Company
Mallory, P. R., & Co., Inc.
Marion Electrical Instrument Co.
Merit Coil and Transformer Corp.
Michigan Bell Telephone Company
Microwave Associates, Inc.
The Montgomery Company
Motorola, Inc.
Mountain States Tel. & Tel. Co.
Muter Company, The
Mycalex Corporation of America
National Company, Inc.
Nelson Technical Enterprises
New England Tel. & Tel. Co.
New Jersey Bell Telephone Company
New York Telephone Company
North Electric Company
Northwestern Bell Telephone Co.
Oak Manufacturing Co.
Ohio Bell Telephone Co.
O'Keefe & Merritt Company
Otis Elevator Co., Electronic Division
Pacific Mercury Television Mfg. Corp.
Pacific Telephone & Telegraph Co.
Packard-Bell Company
Page Communications Engineers, Inc.
Phebco, Inc.
Phelps Dodge Copper Products Corp.
Philco Corporation
Photographic Society of America
Polytechnic Research & Development Co., Inc.
Plessey Company, Ltd., The
Prodelin Inc.
Radiart Corporation
Radio Condenser Company
Radio Corporation of America
Radio Corporation of America, Engineering Products Division
Radio Engineering Laboratories, Inc.
Radio Frequency Laboratories, Inc.
RCA Photophone, Ltd.
RCA Victor Division
Radio Receptor Company
Raymond Rosen Engineering Products, Inc.
Raytheon Manufacturing Company
Red Bank Division Bendix Aviation Corp.
Reeves Instrument Corp.
Remington Rand, Inc.
Remler Company, Ltd.
Rocke International Corp.
Saxonburg Ceramics
Seeburg, J. B. Corporation
Society of Motion Picture & Television Engineers
Sonotone Corporation
Soundscriber Corp.
Southern Bell Tel. & Tel. Co.
Southern New England Tel. Co.
Southwestern Bell Telephone Co.
Sparton Radio-Television Division, Sparks-Withington Co.
Sperry Gyroscope Company
Sprague Electric Company
Stackpole Carbon Company
Standard Coil Products Co., Inc.
Standard Electronics Division, Hupp Corporation
Standard Telephone & Cables, Ltd.
Stanford Research Institute
Stelma, Incorporated
Stewart-Warner Corporation
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Transitron Electronic Corp.
Tung-Sol Electric, Inc.
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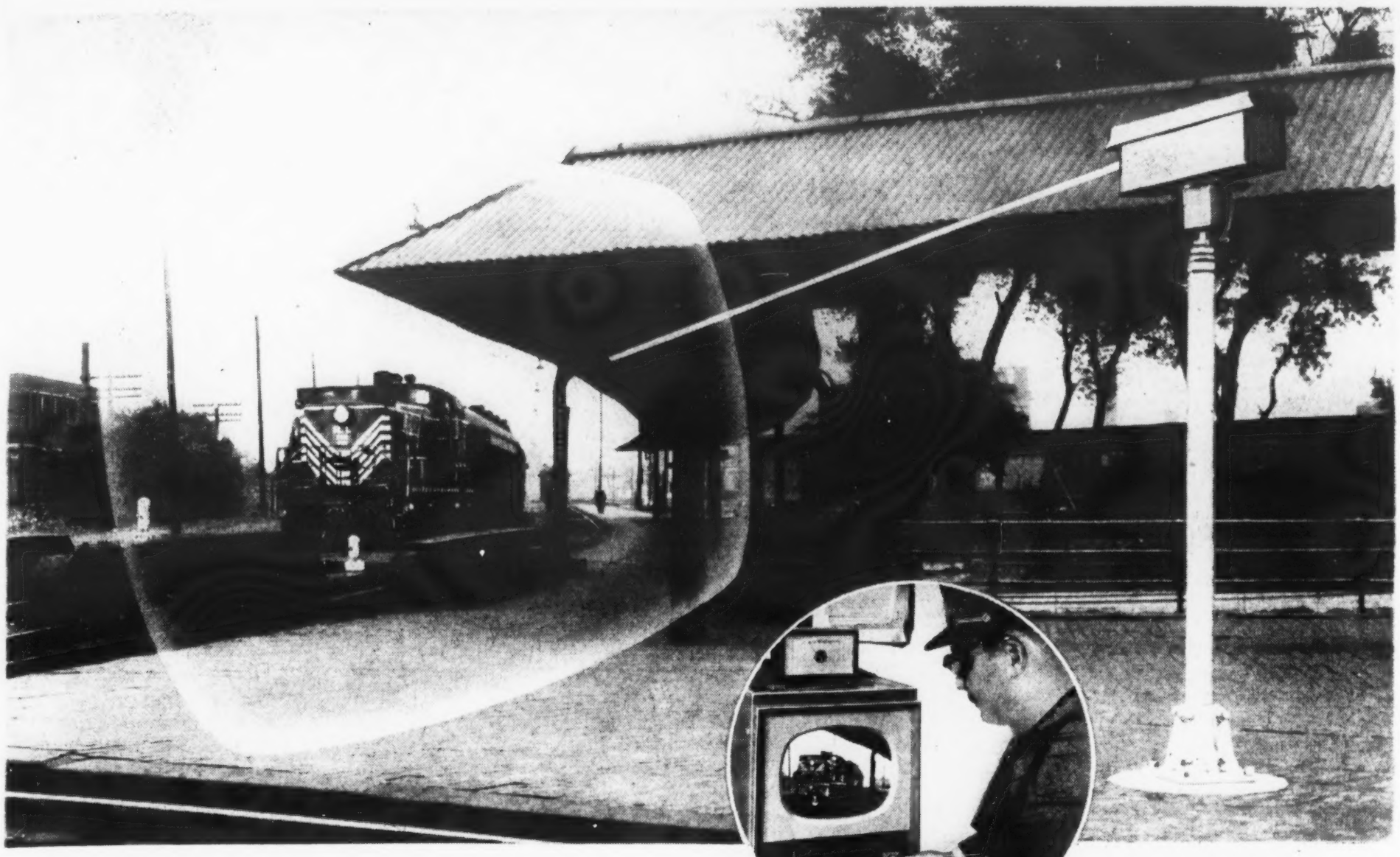
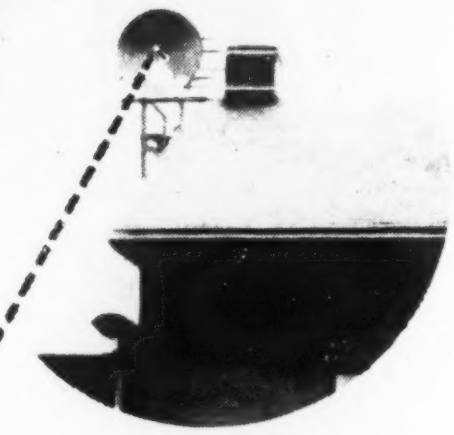
United Transformer Co.
Vectron, Inc.
Voltz Brothers, Inc.
*Wac Engineering Co.
Waterman Products Co., Inc.
*Webster-Chicago Corp., Government Division
West Coast Telephone Co.
Western Electric Company, Inc.
Western Union Telegraph Co.
Westinghouse Electric Corp.
Weston Electrical Instrument Corp.
Whitney Blake Co.
Wickes Engineering & Construction Co.
Wilcox Electric Co., Inc.
Willard Storage Battery Company
Wisconsin Telephone Company
Wollensak Optical Company
Zenith Radio Corporation

*Company accepted for AFCEA Group Membership since the last issue of SIGNAL.

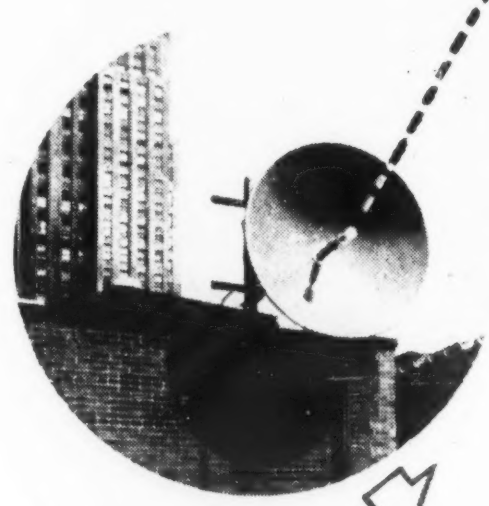


1. A weather-proof, rotating Farnsworth TV camera, mounted on the platform of the Rock Island's busy Englewood station, scans the main-line crossing.

2. The visual information is fed by cable to a TV monitor at the station.



3. Simultaneously, the picture is transmitted by Federal microwave from an antenna on the station roof.



4. A similar antenna receives the picture at the LaSalle Street Union Station and feeds it to another monitor there.

5. Thus, six miles away, Rock Island executives can see the actual loading and unloading of passengers, baggage, and mail, as well as other railroad operations.

Railroad's significant test of

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suggests many applications for closed-circuit TV combined with microwave relay

THE Chicago, Rock Island and Pacific Railroad has shown by this pioneering test how IT&T's TV-microwave system can help solve railroad traffic problems in high-density areas.

The same modern communications technique—product of IT&T research and development—is applicable to the solution of many other problems of traffic control and industrial operations over almost any distance and under practically all conditions.

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67 Broad Street, New York 4, N. Y.

For further information on closed-circuit TV and microwave relay for railway use, address Federal Telephone and Radio Company, 100 Kingsland Road, Clifton, N. J.

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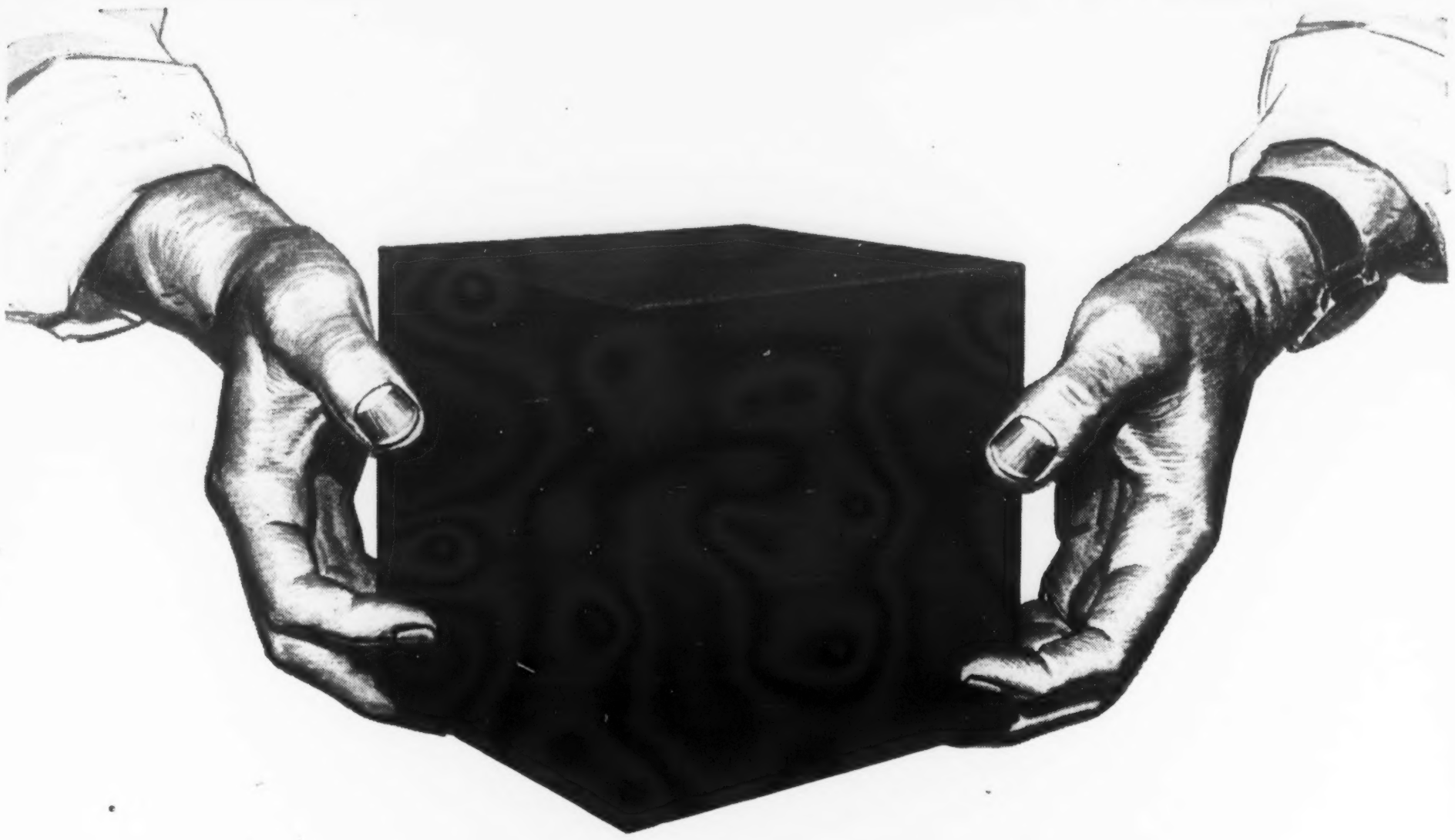
Iowa State College, Ames, Iowa
New York University, N.Y.C.
Northeastern University, Boston, Mass.
Norwich University, Northfield, Vt.
Pennsylvania State Univ., Univ. Park, Pa.



Look closely at this little black box

...IT'S LOADED!

NO MATTER WHO YOU ARE or what you do, the chances are good that this little black box will have a far-reaching effect on your way of life within the very near future.

For this is "TRANSAC"*—*the smallest, lightest, and fastest "electronic brain" yet announced*—and its development by Philco scientists finally unlocks the door to mass production and widespread use of electronic computer and control systems in industry, science, business, and the Armed Forces.

And a well-locked door it was—

Because the demand for the benefits of automatic computation mushrooming out of World War II has, until now, put a breaking strain on computer design. As they have grown more complex they have grown more cumbersome and harder to produce.

Their thousands of vacuum tubes have generated not only heat and the need for bulky air-conditioning, but also problems of power consumption and maintenance. And their size and weight have barred their use in many urgent military applications.

To this dead-end situation Philco engineers brought a fresh outlook and combined it with their experience from pioneering the "Surface Barrier" Transistor.

By utilizing the unique high frequency properties of the Philco "Surface Barrier" Transistor, they evolved an entirely new concept in computer design—the Philco *Direct Coupled* Transistor Circuits.

This "direct coupling" of transistors is the key that unlocks the door.

By one basic stroke, it cuts sharply the number of elements in a circuit, pares down the bulk and weight, slashes cost and production time . . . and speeds up computation!

"TRANSAC", for example, is one-third smaller and lighter, and 10 times *faster* than any transistorized computer announced to date. It operates on one small battery, with less than 1/1000th of the power needed by a comparable vacuum tube computer, and generates less heat than a Christmas tree bulb.

Yet it performs all computer functions—multiplies, divides, compares, and "carries" for 19 binary digits and algebraic sign, and also performs 416,000 complete additions or subtractions per second!

The civilian applications for this system are limitless. And the military uses—with the emphasis on lightweight portability, low power consumption, and high accuracy—are only to be hinted at.

Thus "TRANSAC" becomes one more example of the teamwork of Research, Engineering, and Application that has made "Philco" synonymous with "leadership" in Electronics.

*"TRANSAC"—*Trademark of Philco Corporation for Transistor Automatic Computer.*
For further information, write Philco, 4700 Wissahickon Avenue, Phila. 44, Penna.

ANOTHER FIRST FROM THE PHILCO LABORATORIES

Chapter News

Chapter of the Year—South Texas

Atlanta's retiring president Kelly Mosley (left) hands the gavel to his successor, Col. Aubrey R. Morley, following the annual elections.

Arizona

Committees have been set up to complete the chapter organization as follows:

Membership—Maj. T. W. Kohnstamm, chairman; Lt. H. Z. Kaklikian and F. P. Senko, members. Program—Lt. Col. S. D. Brown, chairman; W. I. Johnson and A. H. Mudgett, members. Nominating—Lt. Col. H. C. Williams, chairman; E. L. Seufert and R. E. Campbell, members.

A complete membership roster has been issued by the chapter to all its members, and plans are being made to inaugurate full scale chapter activity in the fall.

Atlanta

The Philco Corporation was host to the chapter for its May meeting, with 150 members attending a buffet supper and special communications demonstration held in the exhibit hall of the Biltmore Hall.

The Philco equipment on display during guided tours provided an excellent showing of electronics in use today by industry and the armed services. Special television equipment permitted the AFCEA members to see themselves as they were shown on the tour.

The program was arranged by John Ramsey, a director of the chapter, and Southeast Sales Manager for Philco.

Colonel Aubrey R. Morley, Signal Officer of the Third Army, was elected president of the chapter on June 29th.

Other new officers are: H. Jack Evans, first vice president; Charles M. Eberhart, second vice president; R. G. "Snuffy" Smith, third vice president; Thomas B. Harland, fourth vice president; and Albert J. Cartey, secretary.

Following the elections, the 170 members heard a talk given by Colonel F. G. Henry, deputy for operations of the 35th Air Division with headquarters at Dobbins Air Force Base, Marietta, Ga. Colonel Henry is in charge of communications and electronics in the division. He gave an outline of the work being performed by his group.

Augusta-Camp Gordon

Major Eugene E. Reich, an official of the Illinois Bell Telephone and Telegraph Company who was taking summer training at The Southeastern Signal School, was guest speaker at the June 16th dinner-meeting. With "The Reserve Officer" his topic, Major Reich gave an excellent talk on reserve training, stressing the relationship of the employer, the local community, the military establishment and the reaction of the reserve officer to summer training tours and reserve training at his place of residence.

Brigadier General Samuel P. Collins, commanding general of Camp Gordon and an honorary president of the chapter, who was being transferred to Washington, delivered a farewell message to the chapter. Honorary President W. O. McDowell expressed appreciation for his active interest in the Association and extended the chapter's best wishes for his future.

The chapter's July meeting was held at the new Camp Gordon Officers' Club. The consensus was that arrangements should be made to hold future meetings at this site.

Among those present were Col. David Talley, New York Chapter secretary, who conveyed messages from national headquarters and invited the Augusta-Camp Gordon Chapter members to visit his chapter when in that area; and Col. William T. Hartman, Assistant PMS&T at Iowa State College and advisor of the AFCEA student chapter there, who was participating in the summer ROTC training at Camp Gordon.

Col. Otto T. Saar, chapter president, introduced the new commanding officer of the Signal Corps Training Center, Brig. General Ralph T. Nelson, who briefly addressed the group.

The program feature of the evening was a movie entitled "Exploring by X-Rays," which was shown through the courtesy of the General Electric Company. Introductory remarks were made by Francis A. Saxon of the Georgia Power Company.

Baltimore

The United States Naval Academy was host to the chapter on June 18th. This visit to Annapolis is now an annual event of the chapter and is always marked by an excellent turnout of members and guests.

Following a luncheon meeting at the Officers' Mess, members had a choice

Inspecting some special electronic equipment at Atlanta's Philco-sponsored meeting are (l to r): Robert F. Herr, Philco Corp. vice president; Kelly Mosley; and John E. Ramsey, Philco Southeast Sales Manager.

of a tour of the United States Naval Radio Station or a cruise around Annapolis harbor.

New chapter officers for 1955-56 are: president—Henry B. Yarbrough, Bendix Radio; vice presidents—John M. Pearce, Phebco, Inc.; Col. Charles M. Baer, Ft. Meade; Lt. Cdr. John M. Jones, Naval Radio Station, Annapolis; Lt. Cdr. Joseph G. Bastow, USCG, Curtis Bay Yard; Maj. Gen. John W. Sessums, Jr., ARDC; Karl H. Keller, Baltimore Contractors, Inc.: secretary—Dal J. Fausnaugh, Bendix-Friez Instrument Division; treasurer — Frederick Knabe, Jr., Downing Crystal Co.; members-at-large — George C. Ruehl, Jr., Electronic Specialties, Inc., and Emmett T. Loane, Chesapeake & Potomac Telephone Co.

Shown at Baltimore's annual meeting at the Naval Academy (l to r) are: Henry B. Yarbrough, newly elected president; James L. McGowian; John M. Pearce; Adam A. Fiedler; George C. Ruehl, Jr.; Emmett T. Loane; Don C. Lee, retiring president; Lt. Cdr. John M. Jones; and Col. Charles M. Baer.

Boston

Committee chairmen appointed to direct the various phases of chapter activity during 1955-56 are: Captain A. R. Taylor, USN (Ret.), program; Robert A. Rivers, Aircom, Inc., membership; Robert Richmond, General Radio Company, reception; and Kenneth S. Brock, Browning Laboratories, Inc., publicity.

In addition to its regular activities, the chapter is making preparations for the annual AFCEA convention which will be held in Boston next spring.

Chicago

The Navy's new Electronic Supply Office at Great Lakes, Illinois, was the scene of a dinner-meeting on June 9th. Captain E. F. Metzger, commanding officer, was host to the chapter members and guests.

Captain Metzger explained the operations of the Electronic Supply Office, the Navy's multi-million dollar supply-demand control point for all Navy electronic material. This office procures approximately $822,000,000 worth of new electronic maintenance parts each year, and distributes about $50,000,000 worth of parts to ships and shore stations throughout the world. The parts over and above those purchased are drawn from a $350,000,000 stock distributed by Naval shipyards and supply depots located at strategic points in the United States and overseas.

The chapter dinner was in the nature of a farewell for Captain Metzger who was leaving on June 14th to assume his new position as officer-in-charge of Navy purchasing at London, England.

During the business session, new officers were elected as follows: president—Raymond K. Fried, attorney; vice presidents—Carrington H. Stone, consulting engineer; Daniel E. Noble, Motorola Corporation; and Henry J. McDonald, Kellogg Switchboard and Supply Company; secretary-treasurer—Raymond A. Johnson, American Telephone & Telegraph Company.

Board of Directors: William C. DeVry, Paromel Electronics Corp.; Col. LeRoy C. Lewis, USAF, Chicago Air Procurement District; John R. Howland, Dage Television Div., Thompson Products, Inc.; James H. Kellogg, Kellogg Switchboard & Supply Co.; Col. Arvo N. Niemi, Signal Corps Supply Agency; Emerson E. Mead, Kleinschmidt Laboratories, Inc.; Darwin H. Deaver, Automatic Electric Sales Co.; Capt. L. P. Kimball, Jr., USN, Electronic Supply Office; D. B. Miller, Coyne Electrical, TV & Radio School; D. K. Chinlund, Illinois Bell Telephone Co.; Leslie H. Warner, Leich Electric Co.; and Fritz Franke, Hallicrafters Co., outgoing chapter president.

Chicago's June meeting was held at the Navy Electronic Supply Office. Left to right are: Henry J. McDonald, vice president; Frank Meade, outgoing director; Emerson E. Mead, director; Raymond A. Johnson, secretary-treasurer; D. B. Miller, director; Carrington H. Stone, vice president; James H. Kellogg, director; Arthur Schmitt, Amphenol president; Capt. E. F. Metzger, CO, Electronic Supply Office; and Lt. Col. Bernard L. Mathews, CO, SigC Supply Office.

Dayton-Wright

Robert J. McIlrath of Raytheon Manufacturing Company was elected chapter president at the annual elections on May 26th. The other new officers are: vice presidents—F. R. Demchock, Air Materiel Command; W. M. Hilt, Hoffman Laboratories; Ralph A. Root, Jr., RCA Service Co.; Col. F. J. Shannon, Air Materiel Command; and John Wilkinson, American Phenolic Corp.; secretary-treasurer—Mrs. Kitty Thompson.

Directors are: Brig. Gen. V. R. Haugen, WPAFB; John E. Keto, WADC; William Klein, Collins Radio Co.; A. S. Lord, AMC; Brig. Gen. C. H. Mitchell, WPAFB; Maj. John W. Thompson, AMC; John W. Kinnally, Philco Corp.; Will H. McKeehan, General Electric Co.; Brig. Gen. T. L. Bryan, WADC; B. Boettcher, Crosley Div., Avco Mfg. Corp.; Edward M. Lisowski, Philco Corp.; Col. C. H. Lewis, WPAFB; and George Rappaport, WADC.

At a business meeting on June 9th, the following committee chairmen were appointed for the year: George Gardner, civil defense; William Klein, contact; Edward Lisowski, finance; Art Lord, liaison; Charles Meuche, membership; John Kinnally, program; Bert Harrigan, publicity; Lucille Althoff, women's.

An all-day social event on July 27th at the Wright-Patterson Officers' Club took the place of the regular monthly meeting. Ninety-seven members and guests turned out for the occasion.

CHAPTER NEWS

The day's program included golf and swimming, a cocktail party at which the chapter was host, and a gala dinner. Golf and door prizes were donated by Westinghouse, RCA, Sylvania, General Electric, Raytheon, Motorola, Webster-Chicago, Philco and Hoffman.

Louisiana

A dinner-meeting was held on June 27th at the Officers' Mess of Camp Leroy Johnson and was followed by the annual election of officers.

The newly elected president is Charles Pearson, Jr., of Southern Bell Telephone and Telegraph Company. The other officers are: first vice president—W. Ray Gordon, National Cash Register Company; second vice president—Dr. Joseph C. Morris, Tulane University; third vice president—Father Frank A. Benedetto, Loyola University; treasurer—Joseph D. Bloom, Station WWL; and secretary—A. Bruce Hay, Southern Bell T&T Co.

Forty members and guests were present for the meeting and the social hour which preceded it.

New York

One hundred and sixty members of the New York Chapter, their ladies and guests, attended the annual picnic meeting on Governors Island on June 22nd.

Charles Pearson, Jr., District Manager, Southern Bell Telephone & Telegraph Company (left), is congratulated on his election to the presidency of the Louisiana Chapter by C. C. Walther, retiring president.

The weather was ideal and everyone enjoyed the outdoor-cooked meal and all the "fixings." There was also outdoor dancing, the music for which was furnished by an orchestra composed of members of the First Army Band.

Arrangements for the very successful outing were handled by Colonel C. "Bundy" Brown, First Army Signal Officer, and his staff.

North Texas

"New Horizons in Private Wire Services" was the theme of the June 27th meeting held at the Cattleman's Cafe, a favorite steak house in Fort Worth.

Beginning with the history of facsimile transmission, Perry A. Norman, Division Private Wire Sales Manager of Western Union Telegraph Company, traced its development through the years to its present day advancements with prospects for the future.

The lecture-slide-demonstration followed a short business meeting and a delicious steak dinner.

The chapter's July 28th gathering was a ranch style party, with swimming and a chuck wagon dinner, at Wiley's Dude Ranch, eighteen miles from Dallas.

Philadelphia

The annual election of chapter officers brought the following slate into office:

President—Jack P. Barkow, RCA Engineering Products Division; vice presidents—Brig. Gen. William L. Bayer, SigC; Capt. C. H. Anderson, USN; Col. D. L. Rundquist, USAF; J. P. McLean, Philco Corporation; William F. Powell, Jr., Bell Telephone Company; and R. G. Wickes, Wickes Engineering & Construction Company; secretary—Frederick O. Ziegler, RCA Engineering Products Division; treasurer—Robert G. Swift, Diamond State Tel. Co.

Pittsburgh

The chapter's eighth annual banquet was held on June 2nd at Pat McBride's in Pittsburgh and climaxed the 1954-55 chapter season.

Election of new officers took place during the business session with the following result: president—A. M. Crawford, Pennsylvania Railroad Company; vice presidents—G. E. Aderhold, Saxonburg Ceramic & Manufacturing Co.; Maj. John T. Dabinett, Carnegie Institute of Technology; W. W. Ege, Copperweld Steel Co.; M. H. Evans,

San Francisco Chapter members toured the Ampex Corporation plant on July 21st. Below, Clarence B. Stanley, Senior Development Engineer, explains a miniature plug-in amplifier for Ampex's new airborne magnetic instrumentation records.

It's a young man's universe!

No other branches of the armed services today – and few businesses – offer more exciting and unlimited opportunities for the future than are available in the military fields of aircraft, missiles, rocketry and space vehicle development.

Shown here is a glimpse of 600,000 square miles of our planet. It was photographed from a Martin Viking research rocket which attained an altitude of 158 miles. This rocket was one of a series developed by a team of Martin engineers and Navy scientists who have worked together since 1946.

To the young engineer and to the enlistee for military service, this picture says more than words about the immense opportunities to be explored – in uniform or out – in the closely integrated field of military and commercial aviation.

Here, in fact, is one of the biggest futures in the world today.

MARTIN

BALTIMORE · MARYLAND

CHAPTER NEWS

Bell Telephone Company; H. Lundberg, U. S. Rubber Company; H. W. Mitchell, Bell Telephone Company; L. A. Shew, Western Union Telegraph Company; treasurer—W. H. Yates, Western Union; secretary—Harry W. Shepard, Jr., Stanwix Autoparks & Garages.

The new directors are: H. S. Brown, Mine Safety Appliance Company; Dr. J. A. Hutcheson, Westinghouse Electric Corp.; George P. Lang, Carnegie Tech; F. E. Leib, Copperweld Steel Co.; J. G. McKinley, Western Pennsylvania Power; J. I. Seitz, Union Switch & Signal; E. J. Staubitz, consulting engineer; S. C. Stoehr, Bell Telephone Company; W. W. Werner, RCA Service Company; Ralph W. Will, Hamburg Bros.

Sacramento

The program of the June 28th meeting centered around the history and development of the Hammond Organ. Col. Joseph J. Healy, USA (Ret.), company manager and a chapter director, was host to the AFCEA meeting, held at the Sherman Clay Company.

Colonel Healy explained how Laurens Hammond devised the method of taking electrical impulses and creating pure tones, and then, by combining these tones on a harmonic structure, he was able to produce an almost infinitesimal number of beautiful organ tones.

Grouped by the Governors Island Signal Corps' flag during the New York Chapter's annual picnic are (l to r): Lt. Col. A. E. Cotter, Col. T. L. Bartlett, Chapter President Allen Wharton, Vice Adm. Walter S. Anderson, Donald F. McClure and AFCEA National President George W. Bailey.

Following a color film on the Hammond Organ, Mr. Thompson, an accomplished organist, played various types of music on the organ to show its adaptability to any kind of music.

San Francisco

The Ampex Corporation was host to the chapter following the July 21st dinner-meeting held at Ramor Oaks Restaurant, Atherton. Some eighty members and guests were in attendance.

Following the business meeting, Robert Sackman, manager of Ampex instrumentation division and a chapter director, discussed the history of the company, its growth, products and facilities. The members then toured the recently expanded facilities of the Ampex plant in Redwood City. Tour arrangements were made by Ray R. Bourret of Ampex's manufacturing division, program chairman for the meeting.

The tour included a display of models of Ampex recorders used for airborne instrumentation with specialized data handling equipment. Explanations were made of instrumentation equipment which performs such high precision tasks as flight test recording, shock and vibration recording, machine control, process control, geophysical exploration, automatic computation, and the recording of telemetering data from guided missiles.

A demonstration of stereophonic sound revealed Ampex's newest developments in the Audio product division. The AFCEA visitors also were invited to record their voices on the portable Model 600 tape recorder and then hear themselves on a portable Model 620 amplifier-speaker. Ampex audio products include devices for all types of sound recording and reproduction, for entertainment, educational and professional uses and include magnetic tape recorders, reproducers, tape duplicators, specialized theater equipment and amplifier-speakers.

Other facilities shown the group included the recently completed engineering laboratories and expanded facilities for Ampex's manufacturing and marketing divisions.

San Juan

The Officers' Club, U. S. Naval Base, San Juan, was the scene of the May 26th dinner-meeting at which the annual election of officers took place.

Chosen to head the chapter during 1955-56 is Paul A. Girard, Radio Corporation of Puerto Rico, with Captain Walter Linaweaver, USN, and Thomas Ramirez, Antilles Signal Office, as vice presidents. The other officers are: secretary—Albert Pulcini, Puerto Rico Telephone Company; and treasurer—Harry L. Drake, Aeronautical Radio, Inc.

The Board of Directors are: Frederick Wilhem, RCA Communications; Felix N. Gros, Civil Aeronautics Administration; Jorge Toledo, Radio Corporation of Puerto Rico; Joaquin Gandia, CAA; Jose Dominguez, Puerto Rico Telephone Company; and Kinne D. Prachel, Radio and Television Service Co.

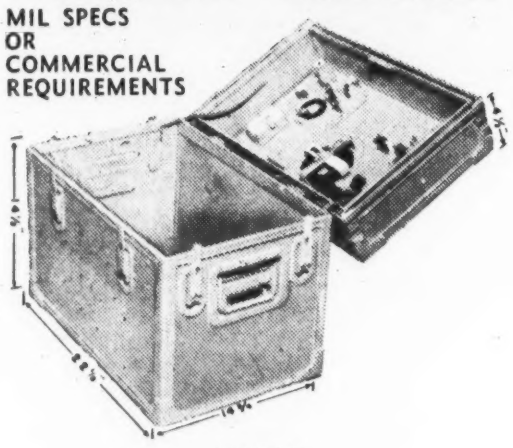
Seattle

A discussion and demonstration of a closed circuit television system for industrial use featured the chapter's June 8th meeting at the Seattle Elks Club. The program was presented by Ron Merritt and Herb Gunderson of the Ron Merritt Company. Equipment used in the lecture-demonstration was from Kay Laboratories.

The speakers pointed out that the extensive application of closed circuit TV in industry was dependent on the development of an improved pickup tube and that the advent of the Vidicon tube, used in the Kay Labs equipment, made this greater application of TV possible. The RCA Vidicon was described in detail as to structure, electrical characteristics and operation.

Some of the applications of industrial television were enumerated as training, plant tours, monitoring of tests, surveillance of large areas, industrial processes, smoke and fire protection, supervision, conferences, medical, military and community systems.

The demonstration set-up consisted of a 16mm projector, pickup camera, video monitor and television receiver. Film and patterns were viewed to show the capabilities of the equipment; then room screens were picked up with



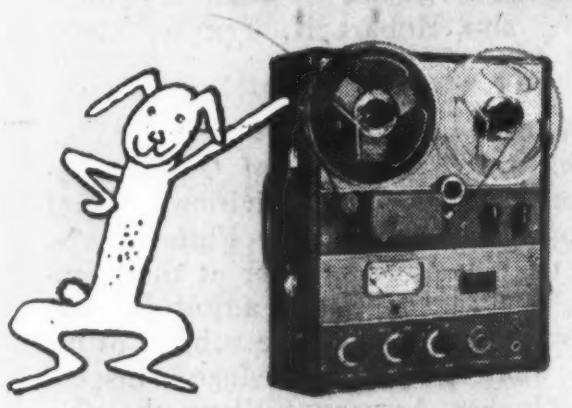
announcing

the new Ampex 610 and 612

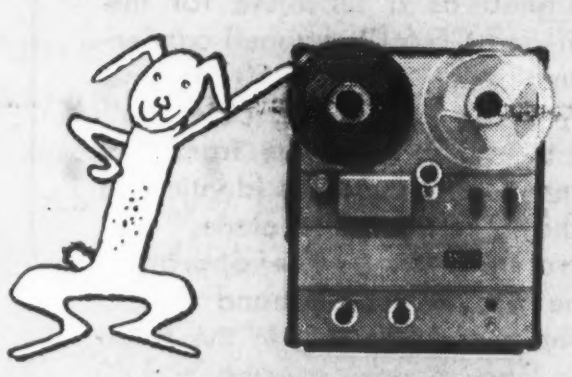
the best now begins at $344...and with this new price comes a smart idea on complete tape equipment for the broadcast or recording studio

Both have all the extraordinary quality and reliability of the Ampex 600 Tape Recorder. They cost less because they are reproducers only. They eliminate chance for accidental erasure—hence are ideal for editing, copying, program auditioning, sales demonstrations and broadcast playback. The Ampex 610 plays half-track and full-track tapes. The 612 plays these and two-track stereophonic as well.

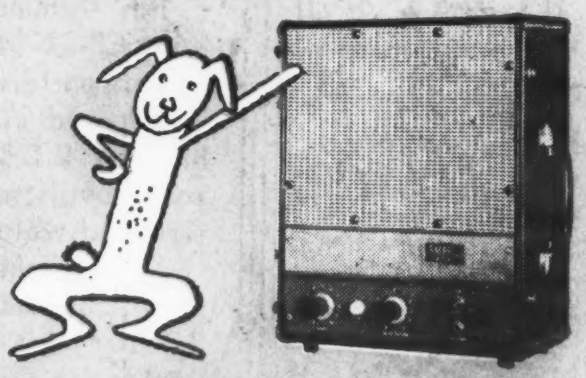
NOW YOU CAN BUY THIS matching family of three FOR THE PRICE OF THE PROFESSIONAL CONSOLE RECORDER



AMPEX 600 — The tape recorder that combines ultra fidelity, timing accuracy, reliability and portability. It has successfully brought the Ampex Standard of Excellence within reach of every broadcast station. Prices are $498 chassis for rack mounting or $545 in portable case.



AMPEX 610 or 612 — The new tape reproducers that have identical characteristics to the Ampex 600. Prices of the 610 (half-track and full-track) are $344 chassis only and $359.50 in portable case or contemporary furniture cabinet. Prices of the 612 (half-track, full-track, and two-track stereophonic) are $379.50 and $395 respectively in same mountings as above.



AMPEX 620 — A companion amplifier-speaker for either 600, 610 or 612 that matches them in portability, appearance and quality. It provides compelling "live sound" demonstrations for selling station programs or spots (and also can be a sensitive station monitor). Prices are $149.50 in portable case, or $169.50 in contemporary furniture cabinet.

For full specifications, write Dept. P-2294

AMPEX CORPORATION

SIGNATURE OF PERFECTION IN SOUND

934 CHARTER STREET • REDWOOD CITY, CALIFORNIA

Distribution in principal U. S. cities (listed in your classified directory under "Recording Equipment"); distributed in Canada by Canadian General Electric Company.

room light and flood light with excellent results.

A question and answer period was conducted at the close of the program.

South Texas

Chapter members met at the White Plaza Hotel, San Antonio, on June 6th as guests of the Tech Rep Division, Philco Corporation, where they viewed the large and impressive Philco Tech Rep exhibit which was currently on display in sixteen other cities throughout the country.

The exhibit illustrated in colorful graphic style the Division's field engineering program, its Technical Publications Department, and featured operating units of the Philco Console Training Demonstrator and Students' Laboratory Chassis.

Following the program, the chapter members were guests at a buffet dinner. Prominently displayed were the "Chapter of the Year" plaque and certificates awarded to the South Texas Chapter at the annual convention in New York.

The July meeting was held at the Brooke Army Medical Center Club, Fort Sam Houston, and was preceded by a social hour and dinner. Guest speaker was Dr. Gordon K. Teal, Vice President in charge of Research for Texas Instruments, Inc.

Dr. Teal discussed his company's electronic program and gave a picture of what can be expected from the industry in the future. Working models of miniaturized equipment using transistors made by Texas Instruments were shown. The members and guests kept Dr. Teal until a late hour asking questions pertaining to the transistors and miniature component research being done by his organization.

South Texas Chapter's display of its "Chapter of the Year" awards is admired by President Howard H. Davenport and Colonel George L. Richon, past president.

Southern California

General Omar N. Bradley was guest speaker at the June 13th chapter meeting. He discussed the importance of electronics in present day warfare and emphasized the fact that the need for adequate and dependable communications is greater than it has ever been before. General Bradley was introduced to the gathering by his old friend and colleague, Lt. General Elwood R. Quesada.

During the meeting, the chapter presented General Bradley with an honorary life membership in the Association together with a specially designed life membership plaque. The presentation was made by Chapter President Richard C. Fuller.

Annual elections were held, with the following chosen to lead the chapter during the coming year: president—Charles A. LaHar, RCA Victor Division; vice presidents—Lester R. Daniels, Nelson Technical Enterprises and The Hallicrafters Company; John W. Atwood, Hoffman Laboratories, Inc.; secretary—Lewis W. Imm, Librascope, Inc.; treasurer—Joel H. Axe, Pacific Mercury Television Manufacturing Corp.

Directors are: John Aalberg, RKO; L. D. Callahan, Gilfillan Bros., Inc.; Holman H. Dillard, Technical Development Corp.; Charles F. Horne, Convair; L. W. Howard, Triad Transformer Corp.; John W. Inwood, Western Union Telegraph Co.; Elwood R. Quesada, Lockheed Aircraft Corp.; Loyd C. Sigmon, Radio Station KMPC; Randolph C. Walker, Audio Products Corp.; and Hobart R. Yeager, Lockheed Aircraft Corp.

Southern Connecticut

Philip Reiter, Chief of Quality Assurance Engineering Division, Signal Corps Supply Agency, Philadelphia, was the principal speaker at the chapter's last meeting before adjourning for the summer months. The subject of his talk was "RIQAP"—Reduced Inspection Quality Assurance Plan—the purpose of which is to provide quality assurance through reduced inspection procedures.

Mr. Reiter pointed out how RIQAP, which is a voluntary inspection plan, has evolved from 100% inspections by both contractor and Signal Corps through 100% end-of-line inspections, then to compulsory quality control (1952) based on statistical sampling, and finally to this latest voluntary plan.

The speaker mentioned some of the basic requirements of RIQAP, such as continuous production, process average equal to or better than the accept-

CHAPTER NEWS

Southern California Chapter officials are pictured with General Omar N. Bradley, distinguished guest speaker at the June meeting. Left to right are: Charles A. LaHar, newly elected chapter president; Lt. General Elwood R. Quesada, director; General Bradley, who holds the life membership plaque presented to him by the chapter; Richard R. Fuller, retiring president; and Lester R. Daniels, vice president.

able quality level, written inspection plan, etc. He also pointed out the many advantages of this plan to both the contractor and the Signal Corps, such as the recognition of quality producers and tremendous savings in dollars and cents.

Southern Virginia

Seventy-eight members and guests attended the June 10th dinner-meeting in the Williamsburg Room of Langley Air Force Base Officers' Club. Special guests of the chapter were Brigadier General Alvin L. Pachynski, Deputy Director of Communications-Electronics, USAF, and Colonel George P. Dixon, AFCEA Executive Vice President.

Mr. J. Rhodes Mitchell, Vice President of the Chesapeake and Potomac Telephone Company of Virginia, was guest speaker and traced the progress of communications in Virginia from the early telephone in 1879 to the current automatic systems, including the use of microwave radio-relay.

Also appearing on the program was Mr. R. Boling Batte, Chief of Technical Services of the telephone company, who presented the technical evolution in communications systems from the early telephone to the current carrier-loaded systems and multi-channel microwave now in wide use for telephone and television transmission on long distance circuits.

During the business session, Colonel Dixon presented the new chapter charter which officially changed the name of the chapter from the Peninsula Chapter, as first organized, to the Southern Virginia Chapter.

Washington

At a recent meeting of the Executive Committee, plans were made for the resumption of chapter activities in the fall.

The Willard Hotel has been selected as the regular meeting place this year and meetings wil be held on the first Thursday of each month beginning with October.

Committee chairmen have been appointed as follows: publicity—Walter H. McDonald, Chief, Office of Technical Liaison, OCSigO; program—Percy G. Black, Automatic Electric Company; membership—Michael J. Macdonald, Department of the Navy; finance—Francis H. Engel, RCA Victor Division.

ITEMS OF INTEREST

From Government, Industry and the Services

REVISED MOBILIZATION REGISTER

The first major revised edition since January, 1954 of the list of planned mobilization producers under the Production Allocation Program has been distributed to military installations and activities by the Department of Defense.

Formerly the "Alphabetical Register of Planned Wartime Materiel Suppliers," it is now called the "Register of Planned Mobilization Producers."

Included in one volume are approximately 30,000 manufacturers who have planned or are developing mobilization production schedules for specific military items.

This new edition of the Register lists plants of all sizes, and includes firms whose normal peacetime production is children's toys, household appliances, refrigerators, automobiles, cosmetics, etc., but whose mobilization production could be converted to military needs during an emergency. (See "The Hook-Up for Industrial Logistics," January-February 1955 SIGNAL.)

Although classified as "Confidential," the Register will be available for inspection by any firm of their specific entry only. To determine if his firm is registered, the management representative should contact the nearest major Army, Navy, or Air Force Procurement office, located in principal cities throughout the United States.

Motorola Transistorized "Radio Timepiece"

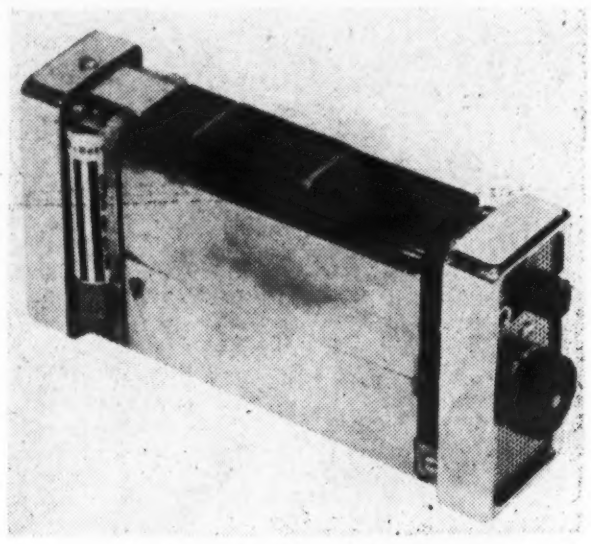
In answer to skepticism regarding the advantages of using transistors, Motorola engineers have developed a special radio receiver which is believed to be capable of ten years of continuous operation with no other servicing than battery replacement.

This pocket-size 13.1 ounce unit, only 5 1/2" x 2 9/16" x 1 1/4" thick, contains a stick antenna, batteries, loudspeaker and volume control, as well as the electronic circuits. The small size and long life are made possible by the use of transistors instead of tubes.

Essential electronic parts are hermetically sealed in a soldered copper case with glass-to-metal seals providing input, output and battery leads. Consequently, the deleterious effects of moisture and dust are prevented.

This receiver is called a radio timepiece because it is tuned to the fixed frequency of 121.95 kc which is the frequency on which the Washington Naval Observatory broadcasts precise time signals at two-hour intervals. Without additional accessories and antennas of any kind, these signals can be picked up night and day as far away as Chicago.

"The moral of this development," says Daniel E. Noble, vice president of Motorola Communications and Electronics, Inc., "is that we should neither try to solve all of our problems by substituting transistors, nor wait for the ultimate perfection of the transistor before we make use of it in logical and practical applications."



Two penlight batteries will operate the Motorola "radio timepiece" receiver continuously 6 hours a day for 25 days. Ferrite loop stick antenna is the slender dark bar visible at the top of the receiver.

EARTH SATELLITE PROJECT HOLDS INTEREST OF WORLD

Plans were announced recently for the construction of a small, unmanned, earth-circling satellite vehicle to be used for basic scientific observations during the forthcoming International Geophysical Year.

The project, which is entirely scientific in nature, will be sponsored by the National Science Foundation and the National Academy of Sciences as part of the United States program of participation in the International Geophysical Year 1957-1958. Technical advice and assistance to the U. S. program will be provided by scientists of the Department of Defense.

An artificial satellite of the earth, placed on orbit by rocket techniques, will provide new and unprecedented opportunities for scientific measurements of the upper atmosphere. The vast amount of space traversed by the satellite during each revolution around the earth will allow the determination of the gross geophysical properties of the rarefied atmosphere and the earth.

For an artificial satellite to remain on orbit, it must break the "space barrier." In order to accomplish this, a satellite on orbit a few hundred miles above the earth must attain a velocity of around 18,000 miles per hour. Once placed on its course with the necessary velocity through rocket techniques, the satellite will continue in its orbit without requiring propelling power. *Such a satellite would circle the earth approximately once every 90 minutes.*

The cumulative effect of atmospheric drag on the satellite will cause its orbit to approach closer and closer to the earth. As it enters the denser atmosphere it will heat up due to the friction of the air and finally, like a "shooting star," completely burn itself out harmlessly far above the earth's surface.

The principal means of observation and tracking will be by telescopes, theodolites and electronic devices. These observations will be assisted by the predictions which can be made regarding the position and path of the satellite at any future time, as determined by electronic computers and disseminated to all participating scientists.

The information collected in research on this project will be available to the scientists of the world.

Varian Klystron Survives Navy Rocket Flight

Surviving the impact following a record-breaking altitude flight of 158 miles in the afterbody of the Viking #11 rocket, a Varian Associates Model V-55 reflex klystron was recovered in operating condition.

This information was released to Varian Associates by the U. S. Navy Chief of Information after compilation of data on the Viking #11

(*Continued on page 76*)

rocket flight held at White Sands Proving Ground, New Mexico, on May 24, 1954.

Varian's V-55 klystron, designed for top performance under extremely rugged service conditions, features high power output for low resonator voltages. It is particularly well-suited for transmitter applications where adequate power output is required from a signal source which must be isolated from the system to which it is connected, or where transmitter power output of the order of ½ watt is desired.

The V-55 operates from conventional power supplies and with conventional crystal mixers. Other important characteristics of the V-55 klystron are: integral matching structure which permits maximum performance with a match load, low microphonics, lock-nut tuning, waveguide output, rapid warm-up, negligible barometric frequency coefficient and extended tuning range.

Pocket-Size, Transistorized Walkie-Talkie Radio

The smallest walkie-talkie FM radio ever built—a transistorized instrument tiny enough to be carried in a shirt pocket, yet powerful enough for two-way communication over a quarter-mile range—has been developed experimentally by the Radio Corporation of America.

This ultra-miniature FM transceiver, designed for military communications in the 45-to-50 megacycle band, features a receiver which is small enough to store in a vest pocket. The receiver could be produced as an independent unit for one-way communication applications to link, for example, a platoon or squad leader with individual soldiers.

Completely self-contained and self-powered, the RCA transceiver houses a receiver-transmitter, microphone-earphone, collapsible antenna, and a battery in a single compact assembly which weighs only 15 ounces. It measures only 5½" high, 3" wide and 1" deep.

Representing a new design approach to walkie-talkie equipment, the transceiver is built around 12 transistors and a single electron tube. According to RCA engineers, application of transistors and new electronic circuitry made possible the achievement of an ultra-miniature unit which offers the advantages of high stability, dependable performance, long battery life, and rugged-

Pfc. John McBride, Fort Carson, Colorado, listens to "battle instructions" over the tiny receiver unit of the RCA transistorized walkie-talkie strapped to his helmet.

ness found in appreciably larger walkie-talkies.

The unit incorporates only two simple controls for two-way communication: a push-to-talk button and a combination on-off and volume-control switch. It requires no tuning or adjustment, and the built-in microphone-earphone provides clearly audible reception when held several inches from the ear.

It can be preset for operation on any frequency between 45 and 50 megacycles and provides up to ten hours of service life with a single tiny radio battery.

New Miniature Battery Developed

A new miniature battery no larger than a penny will maintain constant voltage for a period of two years or more, according to the Elgin National Watch Co. of Elgin, Illinois.

This leakproof battery, designed primarily for an electronic wrist watch now under development, uses inidium as an anode and will not swell or emit gas when in use. The cell is placed in a thin plastic case which occupies only a fraction of the volume normally required for a case.

The semi-circular cell is about 3 times as thick as a dime and will deliver 1.15 volts as compared with 1.35 volts for most other miniature cells.

Tests extending over a period of a year or more show full strength without deterioration. In addition to being suitable as a prime mover for the electronic watch, the cell possesses enough energy to operate other miniature devices over an extended period. Some of these devices include portable radios, recording instruments, hearing aids, photo-flash units and self-focusing cameras. The company states that no cells are available for sale yet.

PRINCESS ROYAL TO VISIT ROYAL CANADIAN SIGNALS

Her Royal Highness the Princess Royal, Colonel-in-Chief of the Royal Canadian Corps of Signals, will honor the Corps by an official visit in early October.

This will be the first visit that HRH the Princess Royal has made to Canada. Major General James D. O'Connell, Chief Signal Officer, U.S. Army, has been invited to attend the special ceremonies in her honor at the Royal Canadian School of Signals, Kingston.

Miniature Weather Station Developed For Navy

A complete miniature weather station set, small enough to be held in one hand, has been developed for the U. S. Navy by the Friez Instrument Division of Bendix Aviation Corporation.

Now undergoing service evaluation tests at sea, this weather recording set weighs about six pounds and is 23 inches high.

When held at arm's length for a few moments the sensing elements of the set quickly position individual dials to measure surface atmospheric pressure, temperature, relative humidity, wind speed and direction. A lever locks all readings in place for subsequent noting and recording in a sheltered area.

Atmospheric pressure is measured over a range of 940 to 1060 millibars by an aneroid barometer mechanism. A bi-metallic thermometer measures temperature over a range of $-10°F$ to $+120°F$.

A pintle mount is provided in the handle so that it may be set in place on a pipe support when desirable. An indexing stud assures correct alignment for wind direction measurements.

The miniature weather station is technically identified as Aerological Measuring Set AN/PMQ-5.

Kodak Executive Looks Into Photography's Future

Photographic film speeds may increase as much as 100 times in the next 75 years, according to Donald McMaster, vice president and general manager of the Eastman Kodak Company. He pointed out that even the high-speed films currently available are not the ultimate.

Speaking at the Master Photog-

(*Continued on page 77*)

raphers dinner at the Photographers Association of America convention in Chicago, Mr. McMaster took a close look into photography's future. On the basis of recent discoveries in emulsion research, photographic scientists believe it will eventually be possible to increase film speeds at least another 100 times, he said.

Mr. McMaster also made these additional predictions on future developments in the field of photography. Film processing — both black-and-white and color — will become much simpler and quicker. Color picture quality will continue to improve, and color film speeds will be greatly increased over prevailing standards. Medical motion picture radiography will become widely used as a tool for diagnosis by doctors. New types of photosensitive materials will come into use, especially in the graphic arts field.

Mr. McMaster emphasized that his predictions are of a general nature, rather than references to specific future products or processes. He based his estimates on developments currently in the industrial research laboratories, on our photographic needs and wants, and on the present directions of science and technology.

Cinerama System Is Improved

The National Theatres Corp. has developed a simplified projection method for Cinerama's wide-screen pictures and has co-sponsored a new electronic lens system of photography, using three strips of film in which the panel lines are barely visible.

In this system a single projection booth is used for the three projectors. The older Cinerama uses three booths, with each projector in a separate booth.

The center projector image is projected directly to the screen and the two images from the side projectors are thrown onto mirrors. The mirrors are set at angles that reflect the beam of light so that the images criss-cross. The picture image from the right projector goes to the left panel of the screen; the picture image from the left projector goes to the right panel of the screen. Besides effecting a much simpler and more convenient projection technique, the single-booth system represents substantial economic savings.

In this newly developed camera system, called Cine-Miracle and developed by the Smith-Dietrich Corp. of New York, the three individual 35

(*Continued on page* 78)

mm film negatives are contained in a single camera, and the lenses are controlled electronically. This automatically compensates for the overlapping of the frames during photographing, rather than during projection as is done now.

Army to Establish Mathematics Center

Plans for establishing an Army Mathematics Center which will carry on research and investigation of mathematical problems outside the capabilities of Army facilities were announced recently by the Department of the Army.

Paramount objective of the Center will be creation of a high quality mathematical group, having as its goal the discovery of techniques directly applicable to Army needs. The organization will be set up by contract with an educational or research institution. A decision as to the location of the Center is expected sometime this fall.

Included in mathematical areas of interest to the Army are numerical analysis, engineering physics of high speed computers, statistics and probability, applied mathematics, analysis, linear and non-linear programming and other highly technical activities.

Graphic "70" Camera now Available to Civilians

The advanced and formerly top secret 70mm high-speed combat camera used by the Army's Signal Corps is now available in limited numbers for civilian photographers, according to its manufacturer, Graflex, Inc., Rochester, New York.

Often described as a "dream" camera because of its many automatic features, the Graphic "70" is probably the most accurate photographic instrument ever built. Resolving power of the camera is the highest ever achieved in a production camera.

The Graphic "70" is ideal for press and other professional photography. Loaded in film cassettes, the 70mm film produces 50 negatives 2¼" by 2¾" on a strip of film 15 feet long. Using the camera's motor-driven film transport, the photographer can expose pictures as fast as he can release the shutter—as many as 10 shots in six seconds.

Its three lenses are interchangeable, and as each lens is inserted, the viewfinder and rangefinder are automatically coupled in proper adjustment. Parallax is also automatically corrected. Because all lens mounts are the same diameter, only one set of filters is needed.

Double exposures are impossible. Ten exposures can be taken with one winding of the spring motor, and when the film is used up, a red flag appears in the viewfinder. A number identifying each exposure is automatically recorded on the film, and a visual dial indicates the number of exposures taken.

Other features include a synchronized shutter with nine speeds from 1/500th second to one second. The focal-plane shutter, made of nylon, will operate in temperatures as low as —45°.

JAPANESE SENDING SERVICE

At military posts, camps and hospitals in Japan, Overseas Telephone and Telegraph Offices are constantly sending Expeditionary Force Messages to families and friends of U.S. servicemen.

The handling of EFM for the United States is one of the telegraph services the Japanese government affords U.S. servicemen, officers, and the American Red Cross.

Any combination of three of nearly 360 standard telegram texts may be chosen for transmission.

Expeditionary Force Messages are handled over long distance telephone or telegraph circuits. A statesidebound message placed in Kyoto is land-lined to Tokyo and short-waved to America.

At present, American military personnel in Korea may also make use of EFM. Via a coupon system, a joint Japanese-American development, troops in Korea may send Expeditionary Force Messages to Tokyo by APO mail. From Tokyo the messages are transmitted by high speed radio to the states along with EFM filed in Japan.

Refinements placed in effect by Japanese telecommunication authorities include the use of multiplex equipment which permits additional channel capacity. This allows the sending of four separate messages to the states by the use of a single radio wave.

The handling of these messages by Japan today is a service of major importance to the U.S. Armed Forces.

by Jerry Adler

Personnel

Electronics Expert Heads Air Force

Recognizing the growing importance of the electronics industry in the nation's defense, President Eisenhower has appointed Donald A. Quarles, well known in the electronics field, as Secretary of the Air Force.

Mr. Quarles, a former vice president of the Western Electric Company has served as Assistant Secretary of Defense for Research and Development since September 1953. From 1949 to 1953 he served as Chairman of the Defense Department's Committee on Electronics of the Joint Research and Development Board.

His appointment is subject to confirmation by the Senate at the next session of Congress.

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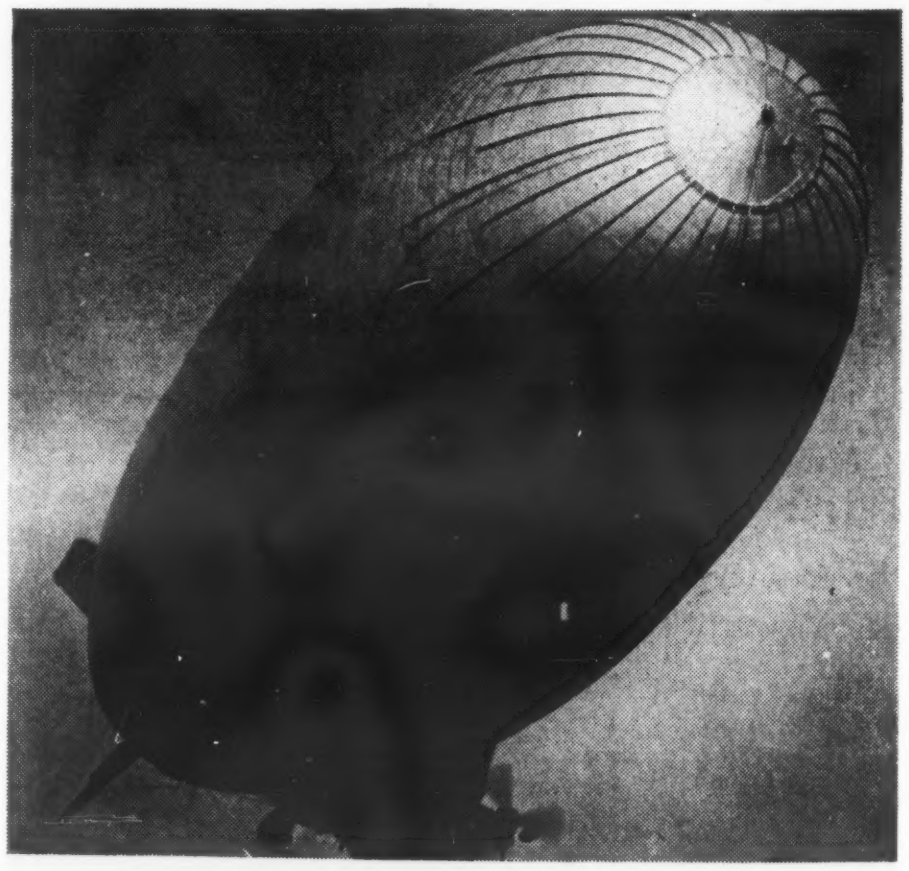


Blimp Defense

New link in the radar network guarding North America is the Navy ZPG-2W radar picket blimp carrying extremely high power airborne search radar produced by General Electric. Radome beneath cabin houses the radar antenna; other electronic equipment is carried inside the cabin. By carrying the radar several thousand feet in the air, the blimp can detect low-flying planes over the horizon long before surface radar equipment.

V. I. P.

VERY IMPORTANT PRIVATE

Not rank, but *function,* determines a soldier's importance. This man is carrying, not just a Walkie-Talkie, but perhaps the fate of an army or a cause. Through him headquarters and other units keep informed; through him pass the orders that unite the efforts of many men into one resistless force. By creating, developing and producing a wide range of electronic equipment for all the armed services, RCA scientists and engineers are helping to provide every soldier, sailor, airman and marine with everything that modern electronics can contribute to military effectiveness, safety and comfort. Because the fighter of today must be trained to understand and operate this equipment, his status is higher than ever before and his opportunities correspondingly better.

RCA

GOVERNMENT DEPARTMENT
RADIO CORPORATION of AMERICA
ENGINEERING PRODUCTS DIVISION CAMDEN, N.J.

ITEMS OF INTEREST

Larkin New Staff Director For Communications in DoD

The appointment of George B. Larkin as Staff Director for Communications in the Office of the Director of Transportation and Communications in the Defense Department was announced recently. He succeeds G. Dean Garner, former Vice President for Personnel of the Southern Bell Telephone and Telegraph Company.

For more than a year, Mr. Larkin has been serving on a loan basis from the American Telephone and Telegraph Company as Chief, Policy Coordinating Branch, in the OTC. Before coming to Washington, he was Assistant Military Communications Manager of AT&T.

The Staff Director for Communications in the OTC serves as the civilian agent for the Secretary of Defense in coordinating the overall program of military communications. While each branch of the armed forces continues to operate its own communications services, each comes to OTC for review and approval of proposed projects.

It has also been announced that the Office of the Staff Director for Communications is being reorganized on a permanent civilian basis. Posts formerly held by military officers will now be filled by civilian appointees, and each of the Services will have a liaison officer with the office of the Staff Director for Communications.

Cassevant to Head Procurement & Distribution Division of SigC

Brigadier General Albert F. Cassevant, who organized the Army's first radar school, has been named Chief of the Procurement and Distribution Division in the Office of the Chief Signal Officer.

Some of his assignments have included Chief Signal Officer, Army forces Western Pacific in 1946; Director of Engineering at the Signal Corps Engineering Laboratories in 1947, and Director of the Evans Signal Corps Laboratory in 1949.

General Cassevant joined the Staff of the Chief Signal Officer in 1951 and was assigned to the Procurement and Distribution Division. He became the Assistant Chief of this division in November, 1951, serving in this capacity until June 1954.

General Cassevant has been Signal Officer of the United States Army Forces Far East for the past 14 months.

Cooke Elected President of West Coast Trade Association

William A. Cooke, vice president and treasurer of Audio Products Corporation of Los Angeles, was recently elected president of the Aircraft Parts Manufacturers' Association of Southern California.

Mr. Cooke, an active member of the AFCEA, will continue as executive vice president and treasurer of Audio Products Corporation in addition to his duties as president of the trade association.

Audio Products Corporation specializes in radar, communications and navigation equipment.

Lanahan Takes Post with Federal Electric Corp.

Major General Francis H. Lanahan, USA, Ret., has recently been named vice president of the Federal Electric Corporation, an associate of the International Telephone and Telegraph Corporation.

"Duke" Lanahan retired from the Army in March of this year after a 38-year career in military communications-electronics.

He was both a national director and vice president of the AFCEA and has been an active member of the Paris, Fort Monmouth and Washington chapters.

Ireland Succeeds Barnhart at BDSA

George Ireland, General Commercial Manager for the Bell Telephone Company of Pennsylvania in its Eastern Area, has succeeded Hugh A. Barnhart as Director of the Communications Division of the Commerce Department's Business and Defense Services Administration.

Mr. Barnhart, who completed his six months' tour of Government service at the end of July, was on loan to the Government from the Rochester, Indiana Telephone Company of which he was president.

Both Mr. Ireland and Mr. Barnhart came into Government service under the program of inviting leaders from industry to lend their experience and background to the task of developing the nation's mobilization and preparedness program.

Promotions for SigC Officers

Promotions for several Signal Corps officers have been confirmed by the U. S. Senate.

The promotion of Brigadier General Emil Lenzner to the permanent grade of brigadier general and to the temporary grade of major general is one of the nominations confirmed. General Lenzner is the Commanding General of the Army Electronic Proving Ground at Fort Huachuca, Arizona.

The following Signal Corps officers have been promoted to the temporary grade of brigadier general: Colonels William D. Hamlin, Commandant of the Signal School, Fort Monmouth, New Jersey; Harold G. Hayes, Signal Officer of the Continental Army Command, Fort Monroe, Virginia, and Ralph R. Nelson, Commanding General, Signal Corps Training Center, Camp Gordon, Georgia.

Daniels to Represent Nelson Enterprises and Hallicrafters

Lester R. Daniels, formerly associated with Audio Products Corporation of Los Angeles, California, has been named representative in Southern California for two midwestern firms.

Mr. Daniels now represents The Hallicrafters Company, Chicago radio and electronics manufacturers, and the Nelson Technical Enterprises of St. Charles, Illinois, a firm specializing in the writing of technical manuals.

Mr. Daniels has long been active in the Southern California Chapter of the Armed Forces Communications and Electronics Association and at the present time is vice president of that group.

Williams Du Mont Distributor

Allen B. Du Mont Laboratories, Inc., of Clifton, New Jersey, has announced the appointment of Colonel Grant A. Williams as Florida Distributor for mobile communications.

Colonel Williams comes to Du Mont with a long and varied career in the electronics field, including association with some of the foremost pioneering engineers of radio communications.

Prior to joining Du Mont, he served in a managerial and consulting capacity with the International Telephone and Telegraph Corporation in Vienna, Austria.

New Vice President for Engineering at Phebco

Phebco, Inc., of Baltimore, Maryland, recently announced that Charles W. Barbour has joined its organization as Vice President for Engineering.

Mr. Barbour was previously associated with the Glenn L. Martin Company of Baltimore, and since 1952 he has been with Teletronics Laboratory of Long Island, New York, as Assistant Chief Engineer.

PERSONNEL CLEARING HOUSE

AFCEA Members Available to Industry

The pages of SIGNAL are open to active AFCEA members who are seeking positions in the communications, electronics and photographic industries. Any member is entitled to space free of charge in this column for three issues of the magazine. Please limit your notice to five lines. In replying, employers are asked to address: Box ——, SIGNAL, 1624 Eye Street, N. W., Washington 6, D. C. Letters will be forwarded to the AFCEA member.

PURCHASING AGENT, EXPEDITING, SUB-CONTRACT ADMINISTRATION. Electronics and associated fields, raw materials and components. 31 years old, 6½ years experience. Seek opportunity with foremost organization in communications field. Compensation secondary to real opportunity. Highly referenced. Box 114.

MANUFACTURERS' TECHNICAL OR SALES REPRESENTATIVE. Twelve years experience in mechanical, ordnance and photographic engineering and associated fields. Full knowledge of Government specifications, standards, contract negotiations and procurement regulations. Free to travel or relocate. Box 115.

EXECUTIVE ASSISTANT, CONTROLLER OR PROCUREMENT DIRECTOR. Experienced negotiator and financial administrator, top management caliber. Degrees in business and in law, admitted to New York Bar. Twelve years experience with airborne electronics procurement and with business affairs of a microwave test equipment manufacturer. Box 116.

Government and Military Positions Available

Government and military agencies are invited to use this column to announce available positions which may be of interest to the readers of SIGNAL. Notices will be published three times if not cancelled before. Applicants apply as indicated in individual notices.

APPLICATIONS ARE REQUESTED for electronic, aeronautical, mechanical, industrial engineering, editorial and photography positions located in the U. S. Naval Air Missile Test Center, Point Mugu, Port Hueneme, California. Applications, and requests for the complete Vacancy List of 39 available positions with salaries ranging from GS-5 to GS-13, should be addressed to: Mr. R. A. Riebow, Employment Superintendent, U. S. Naval Air Missile Test Center, Point Mugu, Port Hueneme, California.

THE SPECIAL DEVICES CENTER, Office of Naval Research, located 25 miles from New York City at Port Washington, Long Island, needs electronic and aeronautical engineers. Applicants must possess degrees in engineering, and pertinent electronic or aeronautical engineering experience. Apply to Mr. David A. Lana, Industrial Relations Dept., Special Devices Center, Office of Naval Research, Port Washington, N. Y.

A CONSIDERABLE NUMBER OF CIVILIAN positions are now being created at the Presidio of San Francisco to replace certain military now occupying administrative positions. These openings include Civil Service Commission rated electrical engineer, civil engineer, mechanical engineer, and architectural engineer. Applicants should apply directly to the Civilian Personnel Division, Building 36, Presidio of San Francisco, California.

RADIO OPERATOR TECHNICIANS. Veterans $3400-$4200 to start. Overseas opportunities. Amateur or commercial licenses helpful. Full pay during advance training. Good advancement opportunities. Submit resume with name, age, address, phone number—if any, military experience, private training, work experience, FCC licenses—if any. Armed Forces Communications and Electronics Association will forward same immediately to employer who will acknowledge your application direct.

TELETYPE OPERATORS AND CRYPTOGRAPHIC TECHNICIANS. Veterans $3200-$3700 to start. Overseas opportunities. Full pay during training period. Good advancement opportunities. Submit resume with name, age, address, phone number—if any, military experience, FCC licenses—if any. Armed Forces Communications and Electronics Association will forward same immediately to employer who will acknowledge your application direct.

MEMBERS . . . MEMBERS . . . MEMBERS

The dates have been set—May 24, 25, 26, 1956. The place has been arranged—Hotel Statler, Boston, Mass. What's the occasion ? ? ? The 10th Annual AFCEA Convention. Plan NOW to attend.

NEW PRODUCTS from Industry

Bendix-Pacific Audio Frequency Tone Oscillators

Automatic verification of the reception and completion of control signals can now be accomplished through transmission of a confirming tone code from remotely controlled equipment back to the control point via the same communication channel.

After reception and execution of a control signal, tone oscillators located in the remote station generate a confirming code which is transmitted to a set of tone detectors in the control station.

Reception of the confirming code causes an on-lamp or off-lamp to light near the control switch, thus indicating that the control order has been received and acted upon at the remote station.

The entire process of control, actuation, and confirmation is accomplished in less than ½ second.

The tone oscillator and tone detector, developed by the Pacific Division of Bendix Aviation Corporation, North Hollywood, California, are of plug-in construction, using printed circuit wiring. Both are designed for continuous, unattended operation.

Broadcast Video Monitor

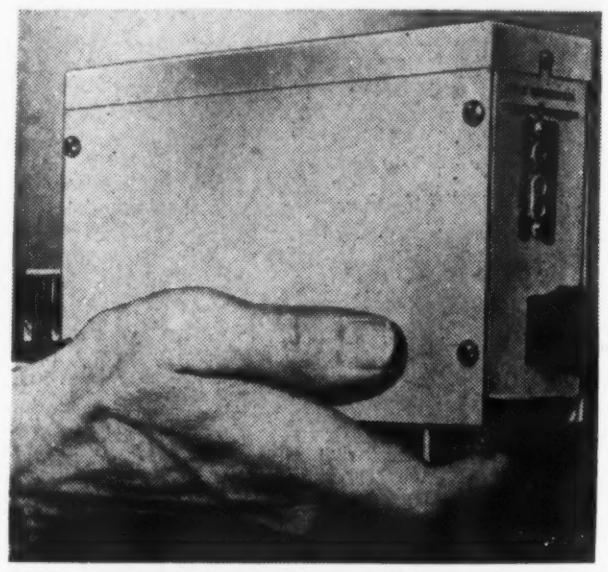
Kay Lab of San Diego, California, has developed a new broadcast video monitor which provides complete monitoring facilities for broadcast station camera chains.

The monitor is complete with "A" scope and illuminated calibrated scale which allows direct measurement of the height of the composite video signal. By means of a switch, two lines or two fields of video information may be viewed on the "A" scope.

Low voltage power supply is fully electronically regulated. The 10-inch kinescope is a flat-faced, tinted, aluminized cathode ray tube. Video amplifiers provide an 8 megacycle bandwidth resulting in an extremely fine resolution of 600 lines.

By using the monitor with a 4-channel switcher-fader, the monitor can be employed as an outgoing line monitor in multiple camera systems. By combining the monitor with the Kay Lab camera control, the monitor can be used as an individual camera monitor or as an outgoing line monitor in single camera systems.

A special control provides for synchronization on sync pulses stripped from the composite video or by synchronization with pulses taken directly from the station sync generator at the choice of the operator.



Commercially available transistor repeater.

Transistorized Telephone Repeater

Engineers at Automatic Electric Company's research and development laboratories have constructed a telephone repeater believed to be the first commercially available equipment of this kind to utilize transistors instead of vacuum tubes.

Field tests of the new transistorized repeater, designated the AT-2, indicate that it is an economical solution to the problem of raising telephone voice transmission levels without using heavier cable or wire, and in some cases eliminating the need as a terminal repeater.

When located near the electrical midpoint of the line, the repeater provides a gain of up to approximately 10 decibels. When installed as a terminal repeater, the gain is somewhat less.

For cable utilizing loading coils, the maximum gain under ideal conditions will be from 6 to 8 decibels.

New Silicon Diodes

For extremely accurate voltage reference, four new types of silicon diodes have been announced recently by Texas Instruments Incorporated of Dallas, Texas.

With reverse breakdown voltage, ranging from 317 to 8.0 volts, the new silicon voltage reference diodes feature extremely small breakdown voltage temperature coefficients from −55°C to +150°C.

This temperature coefficient, which can be positive or negative, is combined with very low dynamic resistance in the breakdown region to provide an ideal device for constant voltage reference purposes.

Because of stringent quality controls and rigid testing during the manufacturing process, the units maintain accurate reference indefinitely regardless of variation in moisture, altitude or other environmental conditions.

These new diodes, types 650, 651, 652 and 653, are expected to have wide application wherever there is a need to stabilize accurate electronic circuits.

Sprague Cera-Mite Capacitors Designed for Automation

Three new designs of ceramic disc capacitors intended specifically for automation have been developed by the Sprague Electric Company of North Adams, Massachusetts.

Closest to the conventional disc ceramic is the pin terminal type which has short stiff terminals 3/16" long. This capacitor is furnished either in bulk or in Tube-Paks for direct magazine loading in component insertion machines.

The second of the disc capacitors is the taper tab terminal unit, also intended for automatic insertion machines. Its flat terminals are designed to jam into chassis slots so that the capacitors will be held firmly during subsequent assembly operations.

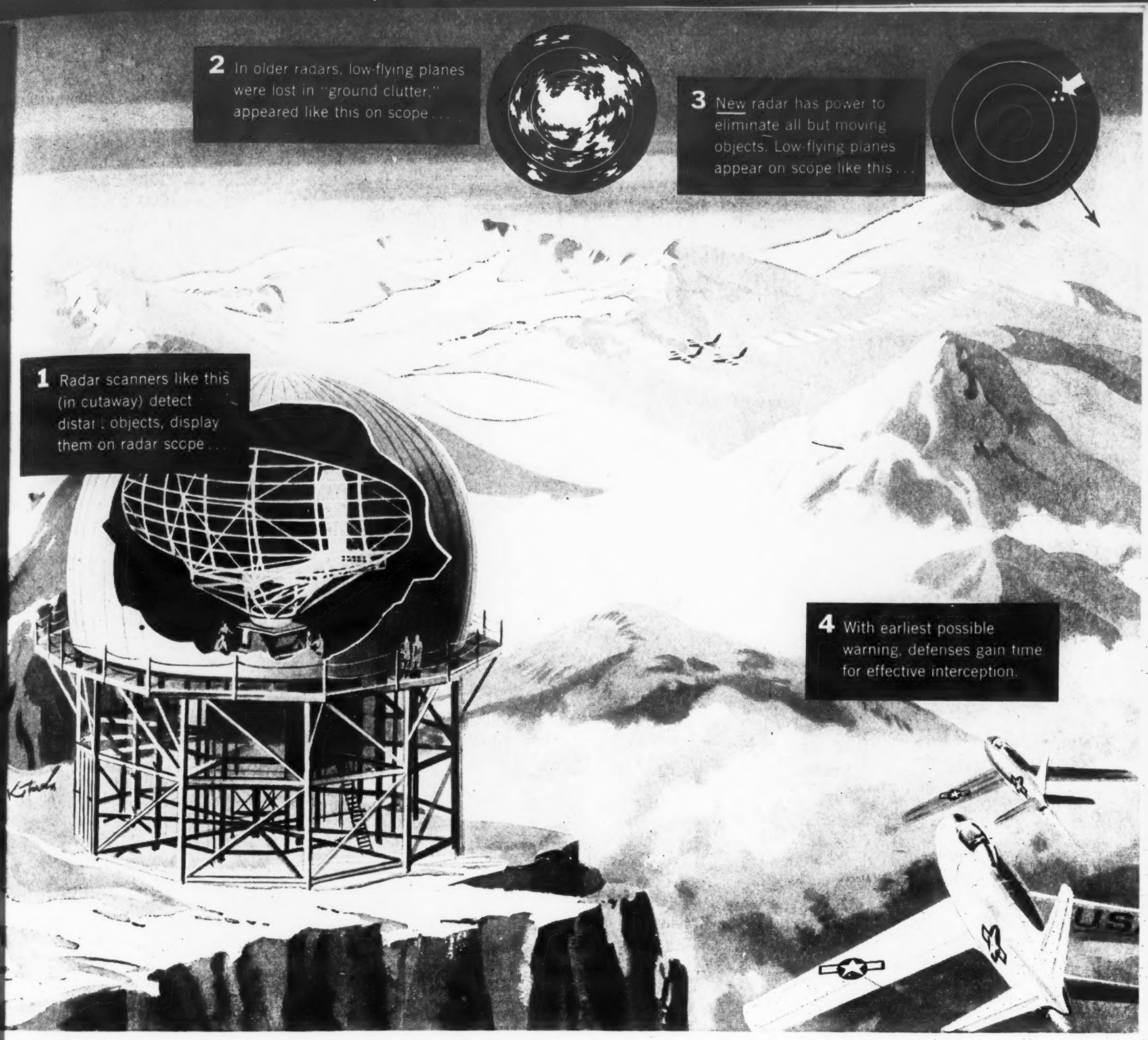
The diametral lead disc capacitor, intended for tape loading in magazines at the television manufacturers' plants, is the third of the new Sprague capacitors. These tape-loaded capacitors have their leads precut to size and can then be automatically inserted by machinery.

Security Alarm System

Browning Laboratories, Inc., Winchester, Massachusetts, has recently announced the development of an all-electronic security alarm system, for both indoor and outdoor areas.

This alarm system is a capacity-type device consisting of a control box and two antenna legs. Any dis-

(*Continued on page* 84)



NEW POWER SOURCE TIGHTENS RADAR DEFENSES

Million-Watt Klystrons Aid Detection of Distant, Low-Flying Planes

THE STORY BEHIND THE STORY:

What is the significance of the headline above? To borrow from an old baseball expression, *"You can't hit 'em if you can't see 'em"*— approaching planes that formerly evaded radar detection can now be "seen" at greater distances than ever before.

■ Behind this improved radar vision is a new family of high power tubes known as Megawatt Klystrons. These new tubes not only provide greater ability for beaming radar impulses against small and distant objects, but provide a new improvement to a technique known as M.T.I. or Moving Target Indication. In radars without M.T.I. everything within the beam of the radar appears on the viewing scope. Images from trees, terrain, buildings, all combine to form "ground clutter" on the scope. M.T.I. eliminates this "ground clutter" by indicating moving objects only. Therefore with Megawatt Klystrons, approaching aircraft can be spotted sooner and defenses can be alerted more quickly.

■ Producing millions of watts of electronic power, these giant tubes make possible illumination of small objects with radar impulses at greater distances to provide clear, sharp images on the radar scope. Furthermore, the Megawatt Klystron's stable performance and long life assure that these radar sentries are constantly on guard.

■ The Klystron tube made microwave radar possible. Developed by Sperry, it generates, amplifies or multiplies microwaves. Today, Sperry produces Klystrons covering a wide range of powers and frequencies for specific requirements— both military and industrial. To meet demands for these tubes, a new plant has just been opened devoted exclusively to Klystron research and production.

SPERRY GYROSCOPE COMPANY
Great Neck, New York
DIVISION OF SPERRY RAND CORPORATION

NEW PRODUCTS

turbance near the protected area will actuate the alarm device of a bell, buzzer, flashing light or other indicator desired by the user.

The system has a synchronous motor to compensate for atmospheric disturbances and is designed to sound an alarm not only for an intruder but also for any changes in the system itself, such as short circuits or tube failure.

Each Browning security alarm system protects a linear distance of 500 feet, and several units can be used together to cover any desired distance.

A major application of the system is the protection of remote areas where guard would be costly. It can, however, be used internally for protection of classified areas and for eliminating personnel access to dangerous equipment.

Philco UHF Mixer Diode

Specifically designed for UHF tuners, a new ultra high frequency mixer diode has been announced by the Government and Industrial Division of the Philco Corporation, Philadelphia, Pennsylvania.

Philco's new tuner diode, 1N173A, is manufactured by a special process which results in characteristics unexcelled in uniformity for high performance tuner operation over the entire UHF band. The diodes are moisture-proof and maintain stability regardless of shock, vibration and temperature variations.

New Switch Available On Mallory Volume Controls

A new type of rotary switch, using unique "floating ring" contact action is now available on volume controls from P. R. Mallory & Company, Inc., of Indianapolis, Indiana.

Make or break of the line circuit is accomplished by spring-snapped, self-aligning motion of rings of special Mallory contact alloy. The rings "float" on pins so that they can rotate slightly with each operation, providing a continually changing contact surface.

Wear and arc erosion are spread around the whole circumference. Make and break action is positive, and switch life is extremely long.

The snap spring which moves the contacts carries no current and will not heat and anneal when overloads occur. Positive snap action "feel" gives definite assurance of switch operation with minimum torque requirement.

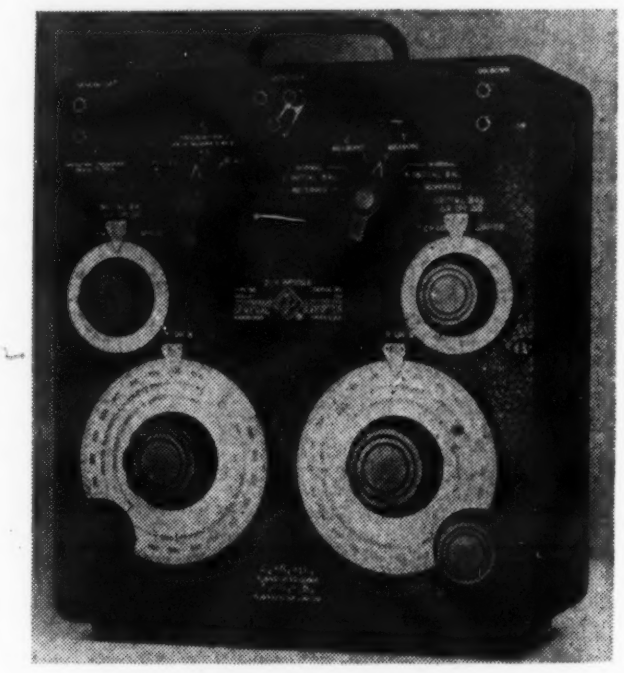
Mallory volume controls from 250 ohms to 10 megohms can be supplied with this new switch at the same cost as attached-switch models.

Audio-Frequency Impedance Measurement Device

General Radio Company of Cambridge, Massachusetts, has developed an instrument which brings a new approach to audio-frequency impedance measurement.

The new General Radio type 1603-A Z-Y bridge can be balanced for any impedance connected to its terminals. From short circuit to open circuit, real or imaginary, positive or negative, a bridge balance can be obtained with ease.

Nominal accuracy of the type 1603-A Z-Y bridge is 1% over the frequency range from 20 cycles to 20 kilocycles. The bridge reads directly the resistive and reactive components, or the conductive and susceptive components, depending on the value of the unknown.



An outstanding feature of the new bridge is its ability to measure impedances which are grounded, ungrounded, or balanced-to-ground.

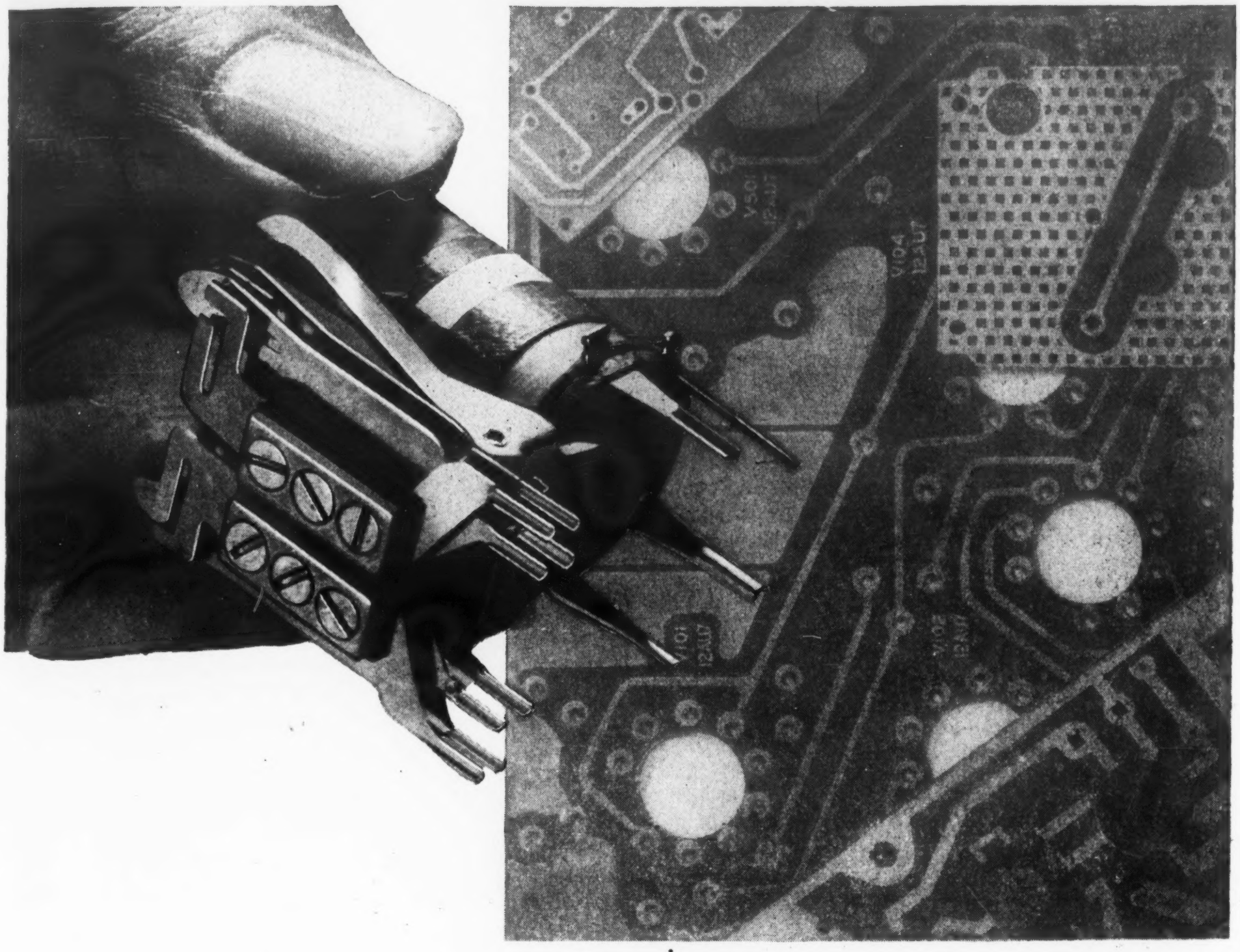
The instrument is useful for measuring the impedance-frequency characteristics of such devices as electro-acoustic transducers, electrolytic and other capacitors, transformers and filters, batteries, feed-back loops and conducting liquids.

Electronic Filter

A new type of electronic filter, providing a higher degree of selectivity than has been possible before, has been developed by L. M. Electronics, Inc., Los Angeles, California.

These filters embody a new kind of electronic filter circuit making possible degrees of selectivity heretofore obtainable only by means of

(*Continued on page 86*)



NOW!

dependable relays for printed circuits

Maybe you, too, have been awaiting availability of a *good* relay for direct insertion into printed circuits. Now Automatic Electric can solve your problem with a miniature relay that is just right.

120 million operations, without a single readjustment or relubrication! That's what you get from this rugged, improved Series SQD Relay, because it features a special *heavy-duty* bearing and bearing pin. Also a recess in the bearing plate retains an adequate supply of lubricant for long-term lubrication of the bearing pin.

Consider these additional advantages:

1. The sections of the terminals that insert into the printed circuit board are NOT brazed or welded into place, but are integral parts of the coil terminals and contact springs—thus preventing internal loss in conductivity or continuity.
2. Terminal design permits direct plug-in of the relay into a printed circuit board, ready to be secured in place with any acceptable soldering technique.

Usually the desired contact spring combination, or pile-up, is sufficiently large so that additional mounting (support) of the relay is not necessary.

SQD Miniature Printed Circuit Relays are available with many different contact spring arrangements, and for a multitude of applications. Springs can be made of phosphor-bronze, "Bronco" metal, or other special-purpose materials, as required.

Of course the long life, heavy-duty features of the improved SQD Relay can be had in the conventional type of plug-in relay, if regular sockets are preferred for use, whether in printed circuitry or other applications.

To get complete details, write: Automatic Electric Sales Corporation, 1033 West Van Buren St., Chicago 7, Illinois. *In Canada:* Automatic Electric (Canada) Ltd., Toronto. *Offices in principal cities.*

RELAYS SWITCHES

PRODUCTS OF THE INDUSTRIAL DEPARTMENT OF

AUTOMATIC ELECTRIC

CHICAGO

mechanical filters. This selectivity can be obtained with band-pass or band-elimination characteristics, or with both characteristics combined in one unit, so that either can be selected by means of a switch on the front of the panel.

The resonance frequency is continuously variable from 30 to 3,000 cps, and the selectivity can be continuously adjusted from a "Q" of zero up to values of 1,000 or more.

As the filter employs electron tubes, the signal amplitude must be kept below a certain level in order to avoid overloading, which would upset the normal operation of the filter. Any signal up to 1.5 volts peak amplitude will give proper operation.

Maxson I-F Amplifiers For Airborne Radar Systems

A new series of subminiature I-F amplifiers used in airborne radar systems and broadband receivers has been developed and produced by Maxson Instruments, a division of The W. L. Maxson Corporation, New York, New York.

Featuring high gain and wide bandwidth, these amplifiers provide performance not obtainable in existing miniature equipment.

Unusual design and construction provide complete shielding and absence of regeneration even with covers removed. Reduction of weight and size is accomplished by use of subminiature components and novel assembly techniques.

Maxson I-F amplifiers are available in three models, M1154 at 30mc, M1155 at 60mc and M1156 at 90mc. They are built to meet rigid military specifications and contain tubes having a rated life of over 5,000 hours.

Eitel-McCullough Klystrons

Eitel-McCullough, Inc., of San Bruno, California, has recently announced the newest addition to their line of high power, ultra high frequency amplifier klystrons.

Designated the 3K3000LA, this klystron will deliver two kilowatts CW power output in 375-600 mc operation. Typical narrow band output is two kilowatts at 525mc with 42% efficiency obtained with a beam voltage of 8000 volts, 0.60 ampere, and a power gain of 1000 times with two watts driving power.

The 3K3000LA features Eimac-developed resonant cavities completed outside the vacuum system, which is free of RF circuitry, permitting wide range tuning and easy input and output coupling adjustment.

Constructed entirely of metal and ceramic, the tube has an oxide cathode and is forced-air cooled.

Radio Studio Control Switching Unit

A new device for the radio broadcasting industry has been developed by the Standard Electronics Corporation of Newark, New Jersey, a subsidiary of the Dynamics Corporation of America.

The device, known as "Studicon," is a studio control switching unit which enables studio operators to select particular channels for transmission of the studio output. Studicon, therefore, eliminates the necessity for a master control while retaining the advantages of a master control system.

Audio connections to Studicon are made with patchcords, and installation can be made without interruption of programming.

A "channel in use" light is lit in all studios connected to the system when any one of the studios is feeding that channel. An electrical interlock system permits only one studio to feed a particular channel at a time.

If a studio wishes to interrupt a program originating from another point, the operator can take control of the channel by releasing a mechanical guard on the channel selector lever switch and throwing the switch to the "by pass" position. When the switch is returned to the off position by the interrupting studio, the original operating condition is restored.

Compact Wireless Microphone

Budelman Radio Corp. of Stamford, Connecticut, recently announced the availability of a new, ultra-compact, wireless microphone, type 127B, specially designed for television, radio, and motion picture use.

Small and light enough to be easily and completely concealed on the person, the new microphone-transmitter overcomes the limitations imposed by conventional microphone stands, booms and trailing cables.

One of the lightest pieces of equipment in this field, it measures 4½" x 2½" x 1". Power is supplied by a compact battery pack which provides a minimum of 5 hours continuous operation.

Power output of the microphone is 75 milliwatts, and when used with the Budelman receiver, type 128B, broadcast quality transmission is easily achieved over distances of several hundred feet.

Return Call Annunciator

Auth Electric Company of Long Island City, New York, has recently announced the development of a new return call annunciator unit with a 180-station capacity that measures only twelve inches wide by fifteen inches high.

This is considered quite an advancement over conventional type annunciator systems which measure about three feet in both width and height and have a capacity of only about 100 stations.

Simplicity of operation is one of the features of the return call annunciator. For example, to call room 512, the operator plugs the phone jack into station 12 on the vertical panel and presses the 5th floor button. The occupant of room 512 answers by pressing a button at his station which extinguishes the light next to station 12 on the master panel.

The unit can be either surface or flush mounted. The relay cabinet may be remotely located.

(*Continued on page* 88)

NEW PRODUCTS

Band-Pass Filter

Krohn-Hite Instrument Company of Cambridge, Massachusetts, has placed on the market a new band-pass filter, model 310-AB, continuously adjustable with unity pass band gain and 24 db/octave slopes outside the pass band.

Both the high and low cut-off frequencies are independently adjustable from 20 cps to 200 kc. This provides maximum flexibility of adjustment of both the band center frequency and the band width.

By using power supply regulation the internal hum and noise has been reduced to less than 1 millivolt. Calibration accuracy is +10%. Accuracy of +5% is available on special order.

Model 310-AB is especially useful in the audio and ultrasonic frequency range for noise measurements, harmonic and frequency analysis, and for psycho-acoustics and electro-medical research.

Subminiature Capacitors for Transistor Circuits

Mucon Corporation of Newark, New Jersey, is now producing a line of high-capacitance subminiature ceramic capacitors whose small size makes them ideal complements for transistors.

Rated at 25 WVDC, these units are available in 5 stock capacitance values ranging from .005 Mf to .1 Mf, measuring 13/64" square max. to 17/32" max. by 21/32" max., with thickness from .090" max. to .110" max.

Made of Mucon's Super-K ceramic material, these capacitors are normally used from 5° to 40°C.

Small in size for their capacitance, these units are finding wide application for by-pass, coupling and tone control circuits in personal transistor radios, auto receivers and other subminiature equipment.

Lightweight Aircraft Inverter

A new 41-pound aircraft inverter, Model SE-24-1, rated 2,250 VA at 35,000 feet, is being produced by Leland Electric Company, a division of American Machine & Foundry Company.

This model is standard equipment on the Martin Matador B-61 in which a high signal-to-noise ratio is a "must" to insure optimum servo-loop performance.

The inverter has electronically controlled carbon piles which regulate power for shunt and exciter fields. Thus both voltage and frequency modulation are a fraction of the allowable specification value, resulting in a reduction in the "noise" level of the servo system.

To maintain this performance under varying conditions of shock and vibration, the inverter control is supported in Leland's special 3-D mount which absorbs mechanical forces imposed from any direction.

Smallest, as well as the lightest unit of its rating now in production, the Model SE-24-1 measures 13¼" long by 9¼" high by 7⅛" wide.

Keyed Sweeping Oscillator

Sona-Sweep model TV, a new keyed sweeping oscillator for precision measurements at the low end of the video band, has been announced by Kay Electric Company of Pine Brook, New Jersey.

A sweep generator with sync pulse added, the Sona-Sweep model TV permits overall visual examination of the low end of the video spectrum. Features include separate controls on sync pulse and sweep generator RF output, and adjustable equalizer for better than 0.5% accuracy in any one region in the band.

Blanking is added to provide zero level base line and permits locking of scope at test receiver end. Output is attenuated in steps for all of the sync and sweep pulse signal.

A frequency vernier control permits observation of specific portions of the spectrum when sweep is turned to narrow range.

Electronic Null Indicator

A new high-sensitivity, high-stability electronic galvanometer, designed to replace the spotlight galvanometers long used for bridge and potentiometer measurements, has been announced by the Shallcross Manufacturing Company, Collingdale, Pa.

Unlike spotlight galvanometers, the new Shallcross type 1965 null indicator is unaffected by mechanical vibration of any sort. This feature, coupled with its high sensitivity and a response time of less than 1 second, allows measurements to be made rapidly and accurately under many adverse conditions.

High sensitivity plus the instrument's high input impedance of 5,000 ohms is a decided advantage for measurements of high resistance. Sensitivity of the type 1965 may be tailored to specific jobs by means of an adjustable front-panel control.

UHF Thermo-Couples

Beam Instruments Corporation of New York City recently announced that a number of new UHF type vacuo junctions (thermo-couples) ranging from 5 MA upwards, have been added to their line of standard types.

Manufactured for Beam by the Best Products Company, the new thermo-couples are extremely small in size, featuring both minimum capacitance and inductance.

The thermo-couples are electrically insulated from the heaters and tested to 100 volts D.C. Resistance tolerances for heater or thermo-couple are +10%. The nominal output is 7 millivolts.

Current ratings can be exceeded by a 50% overload for long periods of time without risk of damage to the thermo-couple; heaters will withstand transient overloads of 100%.

Radar Safety Beacon

Wilcox Electric Company, Inc., of Kansas City, Missouri, recently announced the acquisition of exclusive manufacturing and distribution rights for the airborne Air Traffic Control Transponder designed by Melpar. Inc., the research subsidiary of Westinghouse Air Brake Company. Known as the Wilcox model 714A Radar Safety Beacon, the unit is scheduled for delivery in late 1955.

This instrument meets all require-

(*Continued on page* 90)

ments of ARINC characteristic No. 532 and will provide positive identification and position of an aircraft on the ASR ground radar up to the limit of radar range. It may be installed on all types of aircraft. The Radar Safety Beacon provides the solution to the problem of positive aircraft identification in areas of congested traffic and when flying in Air Defense Identification Zones since Air Defense Command radars are equipped for interrogation.

Several thousand hours of flight time have been accumulated on the Wilcox type 714A Radar Safety Beacon as a result of the installation of six prototypes on aircraft operated in regularly scheduled service by Lake Central Airlines.

Low-Priced Transistor Marketed by General Electric

A new transistor, designed to meet the demands of radio amateurs, hobbyists and experimenters for a stable, inexpensive transistor, has been placed on the market by the General Electric Company.

The suggested distributor price of "well below two dollars" for the new 2N107 transistor makes it the least expensive of any transistor currently available. It is being sold only through G-E distributors.

The 2N107 is the first in a proposed series of transistors which G-E will market exclusively through distributors for use by amateurs and hobbyists. The 2N107 is a PNP audio transistor produced by the G-E fused junction process. Others will include IF and RF PNP transistors made by the fused junction process and RF NPN transistors made by the new rate-grown process.

Housed in an all-metal case, the 2N107 is hermetically sealed for the maximum in reliability. According to G-E engineers, shelf life and exposure to full rated temperature will not change the characteristics of the transistor.

New Folder Available from Whitney Blake

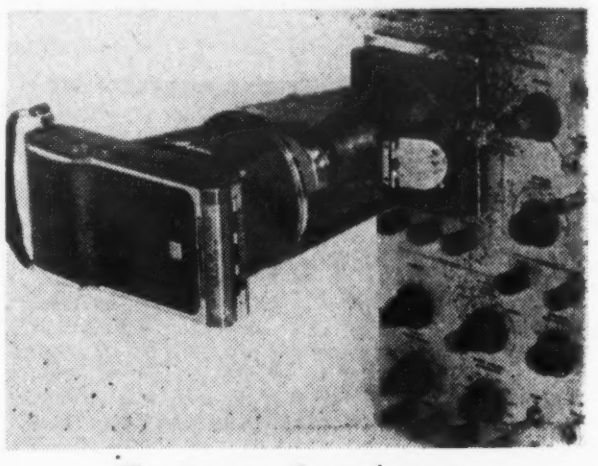
A four-page folder entitled "A New Approach to Connector Problems" is now available from Whitney Blake Company, New Haven, Connecticut.

This fully illustrated folder shows the company's new electrical connectors and explains how many types of AN connectors can be built up from a few basic components.

These connectors have been designed to combine simplicity with greatly increased reliability. They are built to Army-Navy Specification MIL-C-501B, and are waterproof and vibration proof.

The folder illustrates new types of termination provided and describes the new enclosed type socket contact developed for these connectors to provide protection against test prods and abnormal abuse.

For the Photographer



The Aremac Recordoscope

Aremac Oscilloscope Camera

Aremac Associates of Pasadena, California, are now marketing a compact, moderately priced oscilloscope camera capable of providing accurate, single-frame photographic records of phenomena 60 seconds after exposure of the scope image.

This light-weight Recordoscope 1414, of special configuration, mounts easily on any standard 3-inch or 5-inch scope.

The Aremac 1414 can easily record three exposures on a single 2⅛-inch by 2⅞-inch black-field print through the scope centering control adjustment. Full size image is recorded from 3-inch scopes, while 5-inch scope data are recorded at .5 or .7 of full scale.

Over-all versatility and precision performance at a new, lower cost make the Recordoscope highly applicable for industrial, electric, electronic and basic research and development laboratories.

Speed and facility of mounting enables a single camera to service several scopes of various types and manufacture.

New Ansco Camera Outfits

Complete picture-taking outfits, featuring three of Ansco's most popular cameras, are now on the market.

Anscoflex II Traveler camera outfit includes the two-lens gray and silver Anscoflex II camera with a built-in filter to improve sky tones and a close-up lens for portraits. Also included are: camera case, flash

attachment, four flashlamps and two rolls of Ansco All-Weather Pan film.

The Ansco Memar Traveler camera outfit features the Ansco Memar 35mm camera with rapid film transport, f3.5 lens, flash shutter and other features. In addition to the camera case and flash attachment, a roll of Anscochrome high speed color transparency film comes with the outfit.

The third outfit is the Ansco Readyflash Traveler camera outfit for those who desire a simple, rugged, easy-to-use flash camera. Included in the outfit are: readyflash camera, flash attachment, four flashlamps and one roll of Ansco All-Weather Pan film.

Tri-X Wonder Film From Kodak

The Eastman Kodak Co., Rochester, New York, has announced availability of its new high-speed Tri-X emulsion on 16mm film.

The new film will be known as Cine-Kodak Tri-X C-P reversal film. Processing will be done by the purchaser or through independent 16mm processing laboratories. With only minor sacrifices in speed and graininess, the film may also be used to yield negative images.

The daylight exposure index of the Tri-X reversal film is 200, tungsten index 160, making it particularly suitable wherever adverse lighting conditions may be encountered. It is able to withstand somewhat higher processing temperatures than Kodak Super-XX C-P reversal film.

Since it possesses sufficient exposure and development latitude, it may be used, under some circumstances, at speeds higher than its normally rated speed. The film provides improved tonal reproduction with ample detail in both highlights and shadow areas.

Although the new film is extremely sensitive to light, it can be used in a camera with fixed shutter speeds for bright, sunlit scenes by placing a filter over the camera lens. A Kodak ND-3 filter, cutting down brightness by three stops can be used for this purpose. As an alternate, the Kodak Wratten X2 filter which results in little change in the monochromatic rendering of colored objects, can be used.

Cine-Kodak Tri-X C-P reversal film is available in 100- and 200-foot spools, and in 400-foot rolls for darkroom loading, either double-perforated or perforated on one side. It is also supplied on order, spooled for Kodak high speed camera or 16mm Fastax camera.

PHOTOGRAPHIC MOTION ANALYSIS. John H. Waddell and Jennie W. Waddell, Industrial Laboratories Publishing Co., Chicago. $12.50.

Photographic Motion Analysis is a comprehensive compilation of the latest developments in high speed photography. It is designed for engineering information, a reference for professional engineers and technical personnel engaged or interested in the photography of motion.

The authors are recognized authorities on this subject, having been actively engaged in it professionally since 1932. In a sense, it may be said to reflect a great deal of their personal experiences in this field.

When it is realized that the published books on high speed photography are few, one can appreciate the welcome addition to this small collection. The Waddells' book is comprehensive in content and coverage. Some idea of its sweeping content may be gained by a study of the subjects treated. They are: ballistics and military photography, highspeed shutters, explosion and impact studies, light sources, optics in high speed, camera design, basic stereo methods and applications of high speed cameras.

The book is profusely illustrated with many pictures and line drawings. Although it is technically accurate, and complete for a volume of its size, it is believed that a better organization of the material presented and a selected bibliography would greatly improve it. As new editions of the book are promised by the authors, perhaps these reader aids may be included in the revision.

FRANK SMITH

LIGHT CALCULATIONS AND MEASUREMENTS. H. A. E. Keitz, Philips' Technical Library, Eindhoven-Holland. 430 pages, $7.50.

The many modern developments in artificial lighting techniques have led to parallel increases in both the number and the complexity of the problems of light measurement. From fundamental principles of measurement, first laid down by Lambert in the 18th Century, have evolved a complex system of methods of application.

In this book, Mr. Keitz provides a

practical guide to photometry, written to meet the needs of the modern lighting engineer, and in so doing has drawn upon a wealth of practical experience gained during 20 years' service in Philips Photometric Laboratories. Theoretical aspects, the theory of light, refraction and dispersion, photometric concepts and methods of calculation are all adequately covered, but from the viewpoint of the engineer rather than the physicist, and with the mathematics simplified and reduced to a minimum. Throughout, practical aspects are kept to the fore. Such comprehensive data on practical measuring methods have not been available previously in one volume.

The new approach of this book, so different from the usual academic text, will appeal especially to the lighting engineer who tackles the subject from a technological viewpoint, without the background of advanced mathematics and the classical theories of light. Moreover, the wealth of detail on practical methods of light measurement will make this book of value to all interested in lighting problems, whether designer, engineer or physicist.

MIDWAY — THE BATTLE THAT DOOMED JAPAN. Mitsuo Fuchida and Masatake Okumiya, U. S. Naval Institute, Annapolis, Md. 260 pages, $4.00.

The Battle of Midway was without question a turning point of the Pacific War. That much is clear from the results of this sea battle. But as to why the operation was planned and how it was fought, there have been few, if any, detailed and accurate accounts of the Japanese side. The explanation given for this was that the plans for the operation were drawn up exclusively by Combined Fleet Headquarters and the Naval General Staff in Tokyo.

The Japanese forces tried to carry out these plans and suffered defeat —a defeat so decisive and so grave that the details were kept a guarded secret within a limited circle in the Japanese Navy. The result is that today few, even among high-ranking former naval officers, are familiar with the details of the operation. In this book the full story is told.

The co-author, Captain Mitsuo Fuchida, was an outstanding officer in the Naval Air Force. At the outbreak of the war, he was senior wing commander in the carrier task force which was actually the main striking strength of the Japanese fleet. In this capacity, he led the air assault on Pearl Harbor as well as subsequent air strikes by the same task forces.

Captain Fuchida was present at the Midway battle from start to finish on board the flagship of the Nagumo Force. Immediately afterward he was transferred to the Naval War College, with the special assignment of studying and making a report on the battle, using all available records, official and private.

Commander Masatake Okumiya, who collaborated with Captain Fuchida in writing the book, observed the Midway battle from a different vantage point. He was in the light carrier *Ryujo*, flagship of the second task force, which operated in the Aleutians area as the northern prong of the offensive. Later, as a staff officer of the sole carrier division to survive Midway, he had access to all the detailed action reports concerning the battle. Toward the end of the war, he was assigned to the Naval General Staff, where he had ready access to all operational records and reports.

The authors have produced a record which is not only factual, but also eminently fair and objective.

BASIC ELECTRONICS. Van Valkenburg, Nooger and Neville, John F. Rider Publisher, Inc., New York. N.Y. 560 pages, $9.00.

Basic Electronics is the second half of the Navy's Electricity and Electronics training program. The texts of the entire basic electronics course currently in use at Navy specialty schools are covered. The simplification of a complex subject and the presentation of one basic concept at a time combine to make this course a better and quicker way to learn basic electronics.

Correction: On this page last month *Servomechanisms and Regulating System Design* should have had listed as its publisher John Wiley & Sons, New York.

The Technology Press of the Massachusetts Institute of Technology should have been listed with John Wiley & Sons as co-publishers of *Machine Translation of Languages.*

Our Book Department can furnish any book currently in print. We will also help to secure older copies that you may need to complete your library. A 10% discount allowed all Association members on orders of $10 or more. Please indicate author and publisher where known and allow three weeks for delivery.

ARMED FORCES COMMUNICATIONS and ELECTRONICS ASSOCIATION

(COMMUNICATIONS—ELECTRONICS—PHOTOGRAPHY)

1624 Eye Street, N.W., Washington 6, D. C.

CONSTITUTION and BY-LAWS

Adopted April 29, 1947. Revised, May 11, 1948—March 28, 1949—May 12, 1950
April 19, 1951—April 24, 1952—May 15, 1953—May 7, 1954—May 20, 1955.

PREAMBLE

The Armed Forces Communications and Electronics Association, organized in 1946 and incorporated under the laws of the District of Columbia, is a national society of American citizens working toward national security in the fields of communications, electronics and photography.

The Association endeavors to maintain and improve the cooperation between the Armed Forces and Industry in communications, and in the design, production, maintenance and operation of communications, electronics and photographic equipment in time of peace as well as in time of war.

The principal objective of the Association is an active membership of American citizens to whom the responsibility of training, production, maintenance and operation of this type of equipment falls in time of peace as well as in time of war.

The Association is entirely patriotic and non-sectarian; it has no commercial interests and no political alliances. It is not operated for profit and its income is expended in furthering its aims and purposes. Its elected officers serve without remuneration. All American citizens are eligible to membership.

SIGNAL, the journal of the Association, is published for the purpose of disseminating chapter news and other information of interest and importance to the members.

ARTICLE I

NAME AND LOCATION

Sec. 1. The name of the Association shall be Armed Forces Communications and Electronics Association.

Sec. 2. The executive offices of the Association shall be in the City of Washington, District of Columbia.

ARTICLE II

MEMBERSHIP

Sec. 1. Membership in the Association shall be open to American industrial organizations and to all men and women who are American citizens and who are interested in furthering the objectives of the Association, with honorary and associate memberships offered to certain citizens of foreign countries.

ARTICLE III

GOVERNMENT AND OFFICERS

Sec. 1. The government of the Association shall be vested in the Board of Directors, which may exercise all powers and do all such things as may be exercised or done by the Association, but subject, nevertheless, to the provisions of the statutes of the District of Columbia, the Certificate of Incorporation of the Association, and the Constitution and By-laws of the Association.

Sec. 2. The Board of Directors shall consist of 32 members, elected by the Council, each to serve without pay for a term of four years, and divided into four classes of eight members each, one class to retire at the end of the annual meeting each year, or upon the election and qualification of their successors. The Board of Directors shall have the power to fill casual vacancies in its membership and in all national offices of the Association, and to initiate executive measures necessary to achieve the objectives of the Association. The Board shall meet at least once each year, at the same time and place as the annual convention of the Association.

Sec. 3. The officers shall consist of a president, an executive vice president, a first vice president, a second vice president, and such additional number of vice presidents, not to exceed three, as may be authorized by the Board of Directors, a secretary, and a treasurer. With the exception of the executive vice president, secretary, and treasurer, the officers shall serve without pay. All officers (with the exception of the Executive Vice President, the Secretary, and the Treasurer) shall be elected by the Board of Directors at its annual meeting, from the active membership of the Board, to take office at the end of the annual meeting at which they are elected, and to serve for a term of one year following their election, or until their successors are elected and qualify.

Sec. 4. The Board of Directors shall at its annual meeting elect a Counsel to serve without pay for a term of one year beginning at the end of the meeting at which he is elected, or until his successor is elected and qualifies.

Sec. 5. The Board of Directors shall at its annual meeting appoint an Executive Vice President, a Secretary, and a Treasurer, each to serve for a term of one year beginning at the end of the meeting at which he is appointed, or until his successor is appointed and qualifies, and shall fix the annual salary for such period. The offices of Executive Vice President, Secretary and Treasurer may be held by one person, who need not be a director of the Association.

Sec. 6. Regular Service personnel shall not be eligible to hold a paid national office in the Association while on active duty status.

Sec. 7. The Council of the Association shall consist of the members of the Board of Directors and one representative for each 100 members or fraction thereof in each chapter, provided however that no chapter shall have less than two chapter representatives, elected or appointed by the chapter for a period of one year beginning on April 1st of each year. The national president of the Association, or in his absence the senior vice president present, shall serve as Council chairman.

The functions of the Council shall be to elect the Board of Directors and Honorary Members, and to make recommendations with reference to any proposed amendments to the Constitution. Chapters shall have power to fill unexpired terms of their Council representatives. The Council shall meet once each year at the time and place of the annual convention of the Association and at the hour designated by the Executive Committee.

Any chapter, by an instrument in writing filed with the Secretary of the Association, may authorize its representative or representatives present at a meeting of the Council to cast the vote or votes of any of its representatives who may be absent. A majority of the Council votes cast shall be necessary for election to the Board of Directors. Members of the Council are eligible to be present at the annual meeting of the Board of Directors and to participate in the discussions, but shall not have the power to vote.

Sec. 8. There shall be an Executive Committee which shall consist of the President, the immediate Past President, and seven other members of the Board, to be elected by the Board of Directors at its annual meeting for a term of one year beginning at the end of the annual meeting at which they are elected. The Counsel and Executive Vice President shall be eligible to attend meetings of the Committee, but shall have no vote unless they have been elected members of the Executive Committee.

The Executive Committee shall meet at least once each quarter, and at the call of the President or of any three of its members. It shall exercise the powers set forth in the Constitution and By-Laws, also the powers of the Board of Directors between meetings of that Board. All actions taken by the Executive Committee shall be ratified by the Board of Directors at its next subsequent meeting. The Executive Committee shall have the power to fill vacancies for unexpired terms. Notice in writing of the time and place of each meeting of the Executive Committee shall be sent to all members of the Committee at least ten (10) days prior to the meeting date.

Sec. 9. Special meetings of the Board of Directors may be called by the President, the Executive Committee, or any three members of the Board of Directors. Notices of such meetings shall be in writing and shall state the time and place of the meeting, and shall be sent to all Directors at least ten (10) days prior to the meeting date.

Sec. 10. Qualification of Directors and others shall be by acceptance within thirty (30) days by the Director or other persons elected or appointed.

Sec. 11. A quorum of the Council shall consist of 11 members; of the Board of Directors, 9 members; and of the Executive Committee, 3 members.

ARTICLE IV

MEETINGS

Sec. 1. The Association shall hold an annual meeting in the spring of the year at a time and place to be designated by the Executive Committee, which will cause to be prepared a program to include, where possible, the demonstration of such military and industrial communications, electronic and photographic equipment and training as may be authorized.

Sec. 2. The Association may hold such special meetings as may be called by the President or the Board of Directors or the Executive Committee.

ARTICLE V

CORPORATE OBLIGATIONS

Sec. 1. No obligation shall be incurred on behalf of the Association except by the Executive Vice President or by his written authorization and then only to the extent of funds in the Treasury available to meet the obligation. All obligations incurred by the Corporation shall be solely corporate obligations and no personal liability whatsoever shall attach to, or be incurred by, any member, officer or director of the Corporation by reason of any such corporate obligation.

ARTICLE VI

AMENDMENTS

Sec. 1. Amendments to this Constitution may be proposed by a majority vote of the Board of Directors or of the Executive Committee or upon petition addressed to the President and signed by not less than five percent of the total number of full members.

Sec. 2. Proposed amendments shall be submitted to the Council at any annual or special meeting for discussion and recommendations after which they shall be referred for final action to the Board of Directors, which may adopt them by a majority vote of the Directors present at any duly convened annual or special meeting at which a quorum is present.

BY-LAWS

1. AIMS AND PURPOSES

a. To preserve and foster the spirit of fellowship among former, present and future communications, electronics and photography personnel of Industry and the Armed Forces.

b. To commemorate the services rendered by the communication, electronic and photographic industries and of industrial personnel, and by the military personnel assigned to these activities in the wars in which the United States has been or may become engaged.

c. To promote efficiency in military communications, electronics and photography, especially through better liaison between Industry and the Armed Forces, as well as among the three Services themselves. This will include the maintenance of close relations between civilian scientists, engineers, manufacturers and operating companies and those concerned with similar activities in military, naval and air force communications, electronics and photography.

d. To bring to the attention of the membership through chapter meetings and the Association magazine, the importance of thorough cooperation between Industry and the Armed Forces in the communications, electronics and photographic fields.

e. To encourage adequate military training throughout the Nation, the upbuilding of adequate enlisted, and commissioned National Guard and Reserve forces, and effective industrial preparedness for war, in the fields of communications, electronics and photography.

2. CLASSES OF MEMBERSHIP

a. FULL MEMBERSHIP in the Association shall be open to all American citizens interested in advancing the aims of the Association—especially in communication, electronic and photographic phases thereof. Present and former military personnel and civilians employed in the electronic, photographic and communication industries, will be especially encouraged to become full members.

b. LIFE MEMBERSHIP in the Association shall be open to all men and women who are American citizens and who are interested in promoting the objectives of the Association. Life membership shall continue during the lifetime of the life member and shall expire at his death. It shall not be transferable.

c. STUDENT MEMBERSHIP in the Association shall be open to all men and women who are American citizens and who are students in the service academies and schools, and in civilian colleges and universities.

d. GROUP MEMBERSHIP in the Association shall be open to all firms and companies controlled by American citizens who are interested in promoting the cause of industrial preparedness particularly in connection with communications, electronics and photography, and with research, development, production, manufacture, operation, and supply of communication, electronic and photographic equipment. Group members shall have the privilege of naming ten of their employees or officials who are American citizens for full membership in the Association, and members thus named shall pay no individual dues.

e. HONORARY MEMBERSHIP in the Association may be proposed by at least ten full or life members of the Association and a favorable vote by a majority of the Council voting shall be necessary for election.

Honorary membership shall be extended to all former Chief Signal Officers of the Army and Directors of Naval, Air, and Coast Guard Communications, and the Defense Department Directors of Communications as soon as they assume office.

Honorary membership shall be extended to the Chairman of the Joint Chiefs of Staff and to the Chiefs of Staff of the several Services during their tenure of office, and to such other public officials as the Executive Committee may direct.

Honorary membership shall be for life unless otherwise specified at the time of election, provided, however, that the Board of Directors may terminate and cancel the honorary membership of any individual at any time.

Honorary members shall be entitled to all privileges of full membership except as otherwise provided in the Constitution and in these By-laws.

f. FOREIGN ASSOCIATE MEMBERSHIP in the Association shall be open to all men and women who are citizens of those foreign countries where there are officially chartered chapters of the AFCEA and who are recommended by any such local chapter, and to all men and women in the military services of foreign countries who are assigned with, or attached to, any organization, unit or school of the Armed Forces of the United States for duty, liaison, or training. They shall pay the same dues as full members of the Association, and shall be entitled to all privileges of full membership except the right to vote or to hold office, or to attend meetings at which classified information is to be discussed or classified material displayed.

Foreign associate group members may be enrolled in the Association under same conditions and restrictions as foreign associate individual members.

3. MEMBERSHIP INFORMATION—GENERAL

a. The term "members" except where specifically stated otherwise in the Constitution and in these By-laws shall mean full and life members only. Only these may vote or hold office.

b. The election to membership of all classes shall be by action of the Executive Committee, and the decision of that Committee as to eligibility shall be final.

c. Any person desiring to become a member shall make written application to the Executive Vice President. Said application shall be in such form and contain such data as may be prescribed by the Executive Vice President or the Membership Committee, in either case subject to the subsequent approval by the Executive Committee.

d. Any member may withdraw from the Association at any time by tendering his resignation in writing, but such resignation shall not become effective until said member shall have paid all obligations due the Association from him at the time of such resignation.

e. Any member may be dropped for cause by the vote of three members of the Executive Committee or, having been dropped, may be reinstated at the discretion of the Executive Committee.

f. All members are entitled to receive one copy each of the Association publications.

4. MEMBERSHIP DUES

a. The fee for *life membership* in the association shall be fifty dollars ($50.00).
For *full members*, five dollars ($5.00).
For *student members*, two dollars and fifty cents ($2.50).
For *foreign associate members*, five dollars ($5.00).
For *group members*, two hundred and fifty dollars ($250.00), except for small business firms (with 500 or fewer employees) for which the annual dues are one hundred and twenty five dollars ($125.00).

5. OFFICERS

a. The President shall have general supervision of the affairs of the Association and shall perform the duties usual to his office. He shall preside at the meetings of the Council, of the Board of Directors, and of the Executive Committee. He shall be *ex officio* a member of all committees and of all subcommittees thereof. In the absence of the President his duties shall devolve upon the Vice Presidents in order of seniority.

b. The First Vice President shall have general charge of memberships and the activities of local chapters.

c. The Second Vice President shall have general charge of the activities of the National Advisory Committees.

d. The Counsel shall be the legal advisor to the Executive Vice President, the National Officers, the Executive Committee, and the Board of Directors.

e. The Treasurer shall be the custodian of the funds of the Association under the direction of the Executive Committee. He shall render an annual report and such special reports as may be called for by the Executive Committee. The accounts of the Association shall be audited annually by independent auditors. However, in the discretion of the Executive Committee, a certified public accountant designated by it may conduct the annual audit, his report to be made to the Executive Committee.

f. The Executive Vice President shall make collections and disbursements under the supervision of the Executive Committee; shall keep the roster of the members and the records of the status of annual dues; shall be the keeper of the seal of the Association; and shall have the custody of correspondence and records. He shall be responsible that suitable arrangements are made for the annual and other meetings of the Association, of the Council, of the Board of Directors, and of the Executive Committee, the proceedings of which he shall record. He shall submit an annual report to the Board of Directors at its annual meeting, and a quarterly report at the specified quarterly meetings of the Executive Committee. He shall be an *ex-officio* member of all national committees but without the right to vote.

The Executive Vice President shall be responsible for hiring and discharging the necessary National Headquarters personnel and for the management of the Executive Offices and shall have the power to contract in the name of the Association for such services and supplies as are necessary for its operation. He shall have administrative charge of the activities and national programs of the Association, of the Association's magazine SIGNAL, and of all other Association publications.

g. The Secretary shall render the Executive Vice President such assistance as he may require and under the direction of the Executive Vice President perform such other duties as appertain to his office.

6. REGIONAL VICE PRESIDENTS

a. There shall be six Regional Vice Presidents, who shall be appointed by the President, subject to confirmation by either the Board of Directors or by the National Executive Committee.

b. Each Regional Vice President shall hold office from the time of his appointment and confirmation until the next annual meeting of the Association and thereafter until his successor has been appointed and confirmed. The Regional Vice Presidents shall assist the Executive Vice President and the First Vice President in matters pertaining to chapters and in such areas as shall be designated by the President.

7. FISCAL YEAR

a. The fiscal year shall close on March 31, 1951 and on March 31 of each year thereafter.

8. CHAPTERS

a. Upon petition stating that not less than fifteen (15) members of the Association in any locality desire to form a local chapter for the more intimate achievement of the purposes of the Association, the Executive Vice President of the Association shall immediately authorize a meeting for such inauguration, and assist in every way possible toward the organization of such chapter.

b. Upon the formation of a new chapter, the Association will issue a suitable charter, signed by the National President and the Executive Vice President of the Association.

c. Every member of the Association, unless he desires otherwise, will automatically become a member of the local chapter of the territory in which he resides, but no person shall be a member of a local chapter who is not a member of the Association.

The local chapter may collect annually all dues, both original and renewal, for all of its individual and group members. The sum of $5.00 for each full member may be sent to National Headquarters, $1.00 of which will later be returned to the chapter. Or the sum of $1.00 may be withheld by the chapter for each full member and the remaining $4.00 remitted with the application form submitted by the member.

The annual group membership fee of $250.00 ($125.00 in case of small business), either original or renewal, shall be remitted to National Headquarters, and $50.00 ($10.00 in the case of small business) shall be distributed quarterly by National Headquarters to chapters, on a pro rata basis of paid membership at the end of the quarter previous to that in which the payment is made.

d. The constitution and by-laws of each local chapter shall be in the general form of that of the Association and shall be submitted to the Executive Vice President of the Association for review and shall be approved by him before becoming effective.

e. It shall be the general purpose of the chapters of the Association to bring their individual and group members into a closer fellowship with each other and with the communication, electronic and photographic personnel of the Armed Services. This can be accomplished through the medium of chapter meetings, visits to military establishments, industrial plants and laboratories, and through seminars and discussions consistent with the national policies and objectives of the Association.

f. Sub-chapters or posts may be organized by chapters of the Association. Such sub-chapters or posts will be chartered by the parent chapter with an initial membership of at least five members of the Association in good standing. All applications and dues of such members will continue to be handled by the National Headquarters.

g. Student chapters may be organized at any college or university in the United States which carries electronics or communications courses in its curriculum.

A minimum of 10 student members may file petition for a student chapter. This charter will be issued by National Headquarters in accordance with Sec. b of this By-law.

9. RESTRICTIONS

a. No member of the military establishment of the Army, Navy, Air Force, or Coast Guard shall be employed by the Association in a paid capacity, except that articles written for publication may be paid for with the approval of the Executive Vice President.

10. NOMINATIONS AND ELECTIONS

a. On or before March 1st each year the President shall appoint a nominating committee, composed of not less than three nor more than five members of the Association. This committee shall draw up a slate of nominations for members of the Board of Directors to fill the vacancies which will occur in that year. On or about March 1st the Executive Vice President shall notify all Directors and Council representatives that nominations for new Directors are in order and shall request that the Council members submit to the chairman of the nominating committee such names as they desire to nominate for the Director vacancies to be filled.

Any group of twenty or more members in good standing of the Association may submit to the chairman of the nominating committee the name of a candidate or list of candidates, for membership on the Board of Directors. Such a petition shall be in the hands of the nominating committee at least four weeks before the annual meeting. If any person or persons so proposed is not included by the nominating committee in its list of nominations, then any member of that group proposing such person or persons may place his or their names in nomination before the Council at the same time as the names of those nominated by the nominating committee. No other person shall be voted upon or elegible for election as a director. Those candidates receiving the highest number of votes shall be declared elected.

After the nominees are selected and after ascertaining if the proposed candidates will accept the posts indicated, the chairman of the nominating committee will submit the list of candidates for directors, at the annual meeting of the Council for appropriate action.

The officers of the Association will then be elected by the Board of Directors at their annual meeting. A majority of the Directors present shall be necessary for the election of any officers or member of the Executive Committee.

11. AMENDMENTS

a. The Board of Directors shall have the power to adopt and amend the By-laws by a majority vote of those present at any annual or special meeting of the Board at which a quorum is present.

12. INSIGNIA

a. The insignia or emblem of the Association shall consist of:

1. The central figure is an alert powerful American eagle with strong talons clutching lightning flashes—symbolic of a strong America insofar as national defense and especially modern communications are concerned—our basic reason for existence. The border consists of leaves of the olive branch of peace showing that the object of military preparedness in America is to assure a lasting peace. In the background are signal flags—the first means of signaling in the U. S. Signal Corps and a method still used for special purposes by the Navy. Just above the eagle and between his outstretched wings, is a heavy bomber in flight, symbolizing the complicated and essential communication in the Air Force, Marine and Naval aviation, both intra- and inter-aircraft, air-ground and on the ground. Above that is a radar antenna array and at the very top a radio relay antenna—for the latest major step in military communications. In the color version there are the traditional colors of the signal flags—dexter white flag with red center and sinister red flag with white center —with a gold border to the whole.

2. Insignia in this form with ribbon and modifications of it in the form of pins, badges, buttons and rings, shall be authorized by the Board of Directors for use of members. The ribbon shall be of three stripes of equal width, of dark blue, orange, and light blue—total width to be 1⅜ inches.

b. The flag of the Association shall be the above insignia superimposed upon a field of sky blue cloth —representing the medium through which modern signals are transmitted. Under the insignia shall be a scroll on which shall be inscribed "National Security through Military Preparedness."

13. NATIONAL ADVISORY COMMITTEE

a. Members of the Association shall be eligible for membership on National Advisory Committees devoted primarily to the problems of the Armed Services and to the advancement of knowledge, engineering practices and production and design techniques relating to the special fields of communications, electronics or photography and to activities of the Association.

b. These committees shall be organized in conformity with conditions in each particular field rather than according to any standard pattern.

c. Each committee shall have a chairman selected by the President of the Association and approved by the Executive Committee. The other members shall be designated by the chairman. Through meetings, conferences and discussions and in cooperation with local chapters, they shall keep the membership in close contact with progress and developments in their specific fields. They shall meet as committees from time to time to initiate recommendations or reports and shall be available in an advisory capacity on such matters as may be presented for their study and report by the Armed Forces or the Association.

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Because electricity is the ink, current passing through paper from electrodes either fixed or moving permanently marks the paper with shades that correspond to the amount of current.

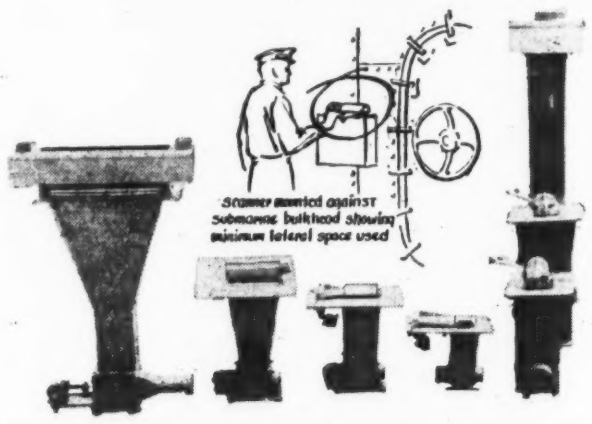
This, plus Alden techniques and patents, with Recorders available, (magazine-loaded or Flying Spot, in every size and speed), give scientists the building blocks to introduce their own ideas and adapt to solving their problems and communications people complete automatic, adjusterless recorders for dependable day in and day out unattended service.

Get complete information in booklet

"RECORDING WITH ALFAX."

ALFAX PAPER & ENGINEERING CO.

Westboro, Mass.



Alden Scanners range in size to transmit from newspaper column size to the width of 19"—designed to use little desk top or counter space. Aboard ship they can be operated at standing height with as little as a foot space in front of bulkhead. In desk scanner the electronics use "only waste paper basket space" below desk, yet the scanner is within hand reach and once copy is started, hands and mind are free as transmission is automatic.

ALDEN DESK SCANNER

SPEED OF IDEA TRANSMISSION— *In Today's High Speed Age — Is Everybody's Problem!*

Leaders feel it is almost unbelievable how ALDEN FACSIMILE SELECTIVE SCANNERS and the ALDEN AUTOMATIC GRAPHIC RECORDERS have anticipated nearly every requirement* of practical convenience to get pertinent information where needed with a minimum of circuit time by providing Building Block Elements that can be combined to accomplish almost any purpose.

- *The problems of accurate—fast idea transmission are always much the same whether you are:*
- *The captain on the bridge.....*
- *The pilot in a plane.....*
- *The man in the control tower...*
- *A teller at a bank window..*
- *A file clerk in an insurance co...*
- *Or your problems are:*
- *Tracking hurricanes by Radar.....*
- *Controlling highway traffic.....*
- *Civilian Defense.....*
- *Construction—Shipping...*
- *Mill operation.....*
- *Inventory control—Railway operation...*


1.


2.

Basically the problem in every one of the above situations is this: *In the least possible time you want to get some information to a second party or parties. *The information to be sent may be typed, written, printed or in a form where symbols, checks or added marks can indicate variations from standard. *This information wants to be recorded quickly and automatically in a graphic form where it can be easily read and used by the second party, so for his convenience in getting a message on on its way the Alden Scanners provide compactness, small top space, and the ability to select pertinent portion of any information. Even on a crowded bridge of a ship only a few inches of top counter space is required in a convenient reaching distance. See 1 above.

The mind reacts quicker to reading than listening—the tower operator transmitting to a plane can through diagram and simple check marks clearly indicate flying or landing instructions to the aviator without any possibility of error, and in much less time than in any other way!

Again, with an airplane's multitude of instruments, there is still room for an Alden Scanner and once the message is placed under the feed roll the aviator does not have to be concerned about the transmission or with the necessity of repeating it as would be the case of voice transmission.

The bank teller wanting a replica of a signature or a bank balance does not need to phone the file clerk but at his counter a small scanner immediately transmits passbook numbers and in a matter of seconds a scanner in the file office selects only the signature on a signature card and transmits it in 5 seconds without either the file clerk or the teller being tied up with a phone, as well as providing continuous record to refer back to or as a log of the day's transactions. See 2 above.

For hurricane warning systems, Civil Defense, Military Operation, a busy line is as bad as no line at all, so here again, selective information or information direct from radar screens, can fan out a circuit with the least possible use of circuit time—so should circuits go out, the information has gotten through—or if the line stays in, it can be available for other purposes.

Over the slowest telephone circuits, the words reduced to typewriting, more words can be transmitted and understood over a telephone line with the facsimile than voice if using the standards of the radio broadcaster of 125 words a minute.

The file clerk in an insurance office, or any office, locates needed information. Because the scanner can be located anywhere, even on a rolling desk, the information is out of the file for only seconds for transmission, and then is put back in place. The scanner can select riders, paragraphs, addresses, or can—if necessary—transmit the complete document.

A new thought in traffic control—Alden Facsimile can be used to speed up or slow down traffic for most effective road use.

In construction operations a Bulletin Recorder can speed up use of large investments of earth moving and other heavy equipment. Toll roads operators and Highway Departments feel that much better use of the road investment results from facsimile communication to bulletin boards, patrol cars, toll centers, and other communication centers.

Civil Defense Administrators can quickly dispatch instruction bulletins to key intersections—telling the public what to do if ever "this road will be closed in case of enemy attack" becomes a reality.

ALDEN ELECTRONIC & IMPULSE RECORDING EQUIPMENT CO.

ALDEN RESEARCH CENTER — WESTBORO, MASS.

We invite you and your key people for a private demonstration at Westboro. Suggest telephoning for an appointment.

*Much of this equipment has been held under wraps to be a complete line capable of economical quantity manufacture and to have a minimum of maintenance costs.

Alden Patents and Techniques in Scanners and Recorders—cover not only automatic operation of recorders—but fast framing—selective scanning and start-stops that minimize circuit time per idea and thus operators' time, cost of circuits, and highest use of equipment investment are assured in the Alden System.

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JUST OFF THE PRESS is a new booklet describing the services available to you at the Mechanical Division. For your free copy address Dept. S-1, Mechanical Division of General Mills, 1620 Central Avenue, Minneapolis 13, Minn.

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MECHANICAL DIVISION OF General Mills, Inc.

HOW FAR IS DOWN?

Knowing exact height above *terrain* rather than sea level is important in navigating military as well as commercial aircraft. The AN/APN-22 radar altimeter, developed by Raytheon and the Bureau of Aeronautics, gives the pilot this precise information. It is now installed aboard planes of the Army, Navy and Air Force. Compact, reliable, accurate—aviation's new radar altimeter is further evidence of Raytheon's "Excellence in Electronics."

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